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October 9, 1924

Engineering News-Record

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Articles of Interest to Municipal Engineers

Redressed Granite Block Paving at Philadelphia
Garbage Disposal Methods, Pacific Coast Cities
Developing Arterial Roads at London
Reports of New England Water Works Association Convention at Rochester and the American Society for Municipal Improvements Convention at Boston

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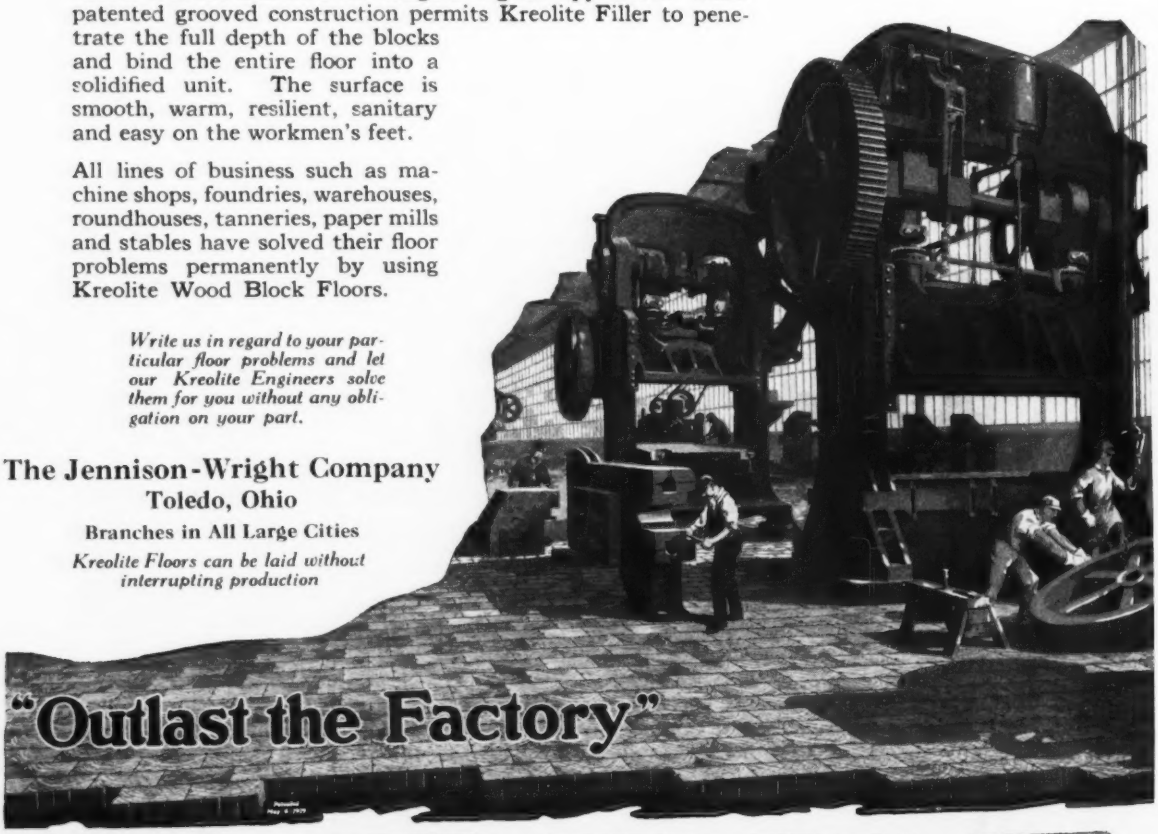

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ENGINEERING NEWS-RECORD

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DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

FRANK C. WIGHT
Editor

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Vote!

IN 1896, 80 per cent of the eligible voters of this country went to the polls and voted; in 1900 this had fallen to 73 per cent and in the succeeding elections the decline was uniform until in 1920 less than half of our voters actually voted. The figures are startling but they are from the official statistics of the Census Bureau. Voting is one of those things that no one else can do for you. Kicking about the government is both a personal and a vicarious avocation. But it should be obvious to the densest mind that to indulge in such kicking without having taken the elementary precaution to exercise the franchise is the nadir of unreasonableness. Only half of the citizens voted four years ago! Don't be in the passive citizen class this November.

City Transit Abroad

AMERICAN engineers who are interested in street traffic problems and particularly in city transportation would do well to read the extended report on city transportation in Europe made by a committee of the American Electric Railway Association which was abroad all last summer. This committee, composed of J. W. Welch, executive secretary of the American Electric Railway Association, A. J. Johnson, assistant general manager, Chicago Rapid Transit Co., and H. L. Brown, editor of *Electric Railway Journal*, visited most of the principal cities of England and the larger continental cities to study primarily the operation of street cars and city passenger buses. The full report is published in the Sept. 20 issue of *Electric Railway Journal*. Much of the detail is, of course, valuable and interesting only to specialists in street railway and bus work, but the general atmosphere of street railway operation and bus operation in Europe is so abundantly present in the report that every municipal engineer who is concerned about traffic, which means practically every municipal engineer, will find his horizon much widened by reading the report. There are a few things apparently in the European cities which are done better than in this country, but the report shows by and large we are not alone in our struggle to meet the almost insuperable problem of getting our growing urban population through our rigid street systems.

Water Pipe Changes

THE large part that pipe plays in the cost of a water-works system, and the high current unit prices for pipe, combine to add interest to papers describing departures in pipe manufacture or comparing the costs and efficiencies of pipe of different materials. Thus at the latest convention of the A.W.W.A. close attention was paid to Col. Maury's paper on four kinds of pipe for large supply mains and at last week's convention of the N.E.W.W.A. the same was true of Col. Longley's paper on recent developments in the case of one of the four kinds of pipe discussed in the earlier paper—reinforced concrete. At both meetings keen interest was also shown in the thinner, lighter and stronger cast-iron pipe produced by new methods. As to the newer cast-iron pipe, disappointment has been felt because there is as yet no clear indication that, foot for foot, it will be any cheaper than the older and heavier cast-iron pipe, while the prospects are that the newer pipe, if lined with cement, will cost more than ordinary cast-iron coated with tar. If, as the two methods of spinning cast-iron pipe develop, competition does not bring the prices down it is certain that increased attention will be given to substitutes for cast-iron pipe. For the larger sizes of supply mains, as contrasted with distributing mains, the range of materials now competing with cast-iron is already appealing, and with advances here they may be hoped for in the case of distribution mains also, although for sometime to come cast-iron pipe, whether actually cast or spun by one of the new methods, will presumably dominate the field.

Architectural Limitations

ADMITTING that the engineer's usual criterion of beauty in structures is "I don't know anything about art but I know what I like," most engineers have been more than annoyed at the attitude of the architect toward the structures that engineers build. It appears to be an accepted fact in the architectural profession that the engineer goes out of his way to make things ugly and that in bridges, particularly, there is a studied neglect of all of those principles of artistic design which tradition, at least, has established as the fundamentals of beauty. On his part, though, the engineer has his criticism of the architect, and disclaiming any authority in this matter of art or beauty, he frequently voices it. One instance, oft repeated, is the apparent neglect of any attempt at cooperation of the architects of adjacent city buildings—an independence which, for instance, years ago brought about the grotesquely divergent Singer and City Investment towers, built simultaneously on interlocking lots in lower Manhattan. Another instance is the new Equitable Building which meets the eye as this is being written. Here is a structure of unusual architectural pretense decorated in a rather florid style that is, to the layman, quite effective. From a near view the whole building is architecturally pleasing. But when one gets away from it one finds that the tall building has been laid out in symmetrical elevation, with elaborate cornice ornament in fine balance—but rising above this nice symmetry is an overpowering pent-house, off center and of varying height, looking more than anything else like one of the notorious three-decker tenements of the New England mill towns. If this be architectural art give us more of the engineering kind.

Centralized City Engineering

IN striking contrast to the decentralization of engineering work under the new Los Angeles charter, reviewed and commented on in our issue of Aug. 28, is the plan for centralizing all engineering and construction work of the City of Baltimore, just advised by a committee and approved by the mayor, but requiring councilmanic action and then approval by popular vote before it becomes effective. The Baltimore plan provides for a department of public works headed by a chief engineer under whom there would be 11 bureaus, some of which would be headed by an engineer who would take the place of an existing board. Granted that Los Angeles has the million people it now claims it is not so much larger than Baltimore as to make imperative numerous "citizen" boards in addition to a board of public works to carry on the same general line of activities as would be handled by the proposed single department in Baltimore. That the arguments in favor of decentralization at Los Angeles preponderated in the minds of the charter commission and the voters at large is sufficient warrant for giving decentralization a trial there and the same will be true of centralization at Baltimore if finally adopted for that city. Both cities having tried decentralization. One has decided for still more of it and the other is advised to get as far away from it as possible. If the matter were left to engineers, in and out of city offices, we think a goodly majority of them would favor centralization of city engineering and construction, under a single-headed department and bureau plan, as is proposed at Baltimore.

Tax Exemption for Municipal Engineers

ENGINEERS will benefit little if the Supreme Court sustains the federal income tax decision in the test case brought by Leonard Metcalf in the interest of engineers doing state and municipal work. Reduced to its lowest terms, the decision means that exemption can be granted to engineers only when they are "regular employees of a state or subdivision thereof." The term "regular employees" is not defined in the decision, which is given in full elsewhere in this issue, but light is thrown on the court's understanding of the term by its language in justification of the two items exempted. Mr. Metcalf is allowed exemption because year after year he has been employed as chief engineer of a water district; Mr. Eddy gets exemption because of his appointment on a board of engineers authorized by an ordinance passed by a sanitary district.

This seems to be the narrowest possible interpretation of the public official exemption clause of the War Revenue Act of 1917. The act does not contain the word "regular," used by Justice Lowell, but unqualifiedly excepts "the compensation or fees received by officers and employees under the United States, or any state, territory or the District of Columbia, or any local subdivision thereof." The decision in the Metcalf case does, however, base its limitations of exemption to *regular* employees on an earlier case, cited by reference only.

Accepting the decision at its face value, an engineer would have to rest his claim for income tax exemption on an appointment to a position more or less definitely provided for by statute, city charter or ordinance, or on a resolution based on one of these. That is, legal membership in the official family would have to be established.

Beyond this small concession, the pleadings of the attorneys for the plaintiff were of no avail. They urged that imposing an income tax on receipts of engineers from municipalities for professional services was a violation of state sovereignty (the municipality being a creature of the state). The court dismissed the claim as insignificant. Had this claim been recognized, it might have benefited engineers rendering almost any kind of professional service to cities or states—for paving, bridges, valuation, etc.—as well as various other classes of experts.

A claim much narrower in the classes of engineering services embraced received more consideration from the court but was likewise rejected. This was that municipal water-works and sewerage are vital governmental functions. The court summarily dismissed the claim as regards water-works, falling back on the legal precedent that supplying water is not a governmental function but ignoring its own admission that water supply for fire protection is such a function. Curiously enough, as viewed by the sanitary engineer or public health official rather than the lawyer, the court accepted sewerage as a governmental function because it affects the public health—another legal precedent. Any layman knows, or could be shown, that water supply far more vitally affects the public health than does sewerage or other so-called sanitary services.

As the court recognized water for fire protection as a governmental function, and since a pure and plentiful water supply is a health matter, only legalistic reasoning would refuse to give water supply as much consideration as sewerage. However, recognition of sewerage as a governmental function did not alter the net effect of the decision, so refusing to class water supply with sewerage as a health service does not matter for the immediate case, unless from the cumulative viewpoint; that is, the sum total of federal interference with municipal health matters would be largely increased if water supply were recognized as a far more vital health matter than is sewerage, and if to these two there were added professional services on other problems affecting the public health.

Before leaving the question of water supply as a health service, it may be noted that the courts repeatedly recognize the vital relationship between water supply and health every time they allow damages against a city or a water company for typhoid fever due to a contaminated water supply (see summary of decisions, *Engineering News-Record*, Sept. 25, 1924, p. 495). Here is another anomaly of the law and its interpretations: a city is mulcted for damages in such cases, not because it has failed in a health protective function, but rather for non-fulfillment of the private function which it, so the law stands, has voluntarily assumed of supplying water to private consumers.

Unquestionably, the decision, if sustained, will cause an increase in fees for engineering services to public bodies, except as it has already been anticipated. It will also lead to statutory, charter, ordinance and resolution provisions that will more often bring consulting engineers, chemists, bacteriologists and other experts into the official family, and take good care to see that in doing so non-residents are not debarred.

Garbage Disposal on the Pacific Coast

CLIMATIC and living conditions in southern California and in the Pacific northwest are so different that it is not surprising to find a great difference in the garbage and refuse of the cities of these two sections as regards moisture, organic, ash and other mineral content. But these variations are insufficient to account for the wide differences in disposal methods in vogue along the Pacific Coast noted elsewhere in this issue. Los Angeles sells its garbage f.o.b. cars for 60c. per ton while San Francisco pays $1 per ton to have its refuse burned in a destructor that it supplies for the purpose. Oakland hauled its refuse out to sea until the steamer was wrecked and now dumps and covers its refuse on its bay shore property. Seattle abandoned incineration in favor of the present successful and relatively inexpensive method of filling land with refuse, Sacramento has abandoned hog-feeding for incineration; Portland, after dependence on incineration now relies chiefly on the sanitary-fill method used at Seattle.

With the exception of reduction, which does not seem to have been used anywhere west of St. Louis, city officials on the Pacific Coast, like those in other parts of the country, are adopting here one and there another method of disposal, while in the same city changes from one method to another follow each other, sometimes with bewildering frequency. On the Pacific Coast, as elsewhere, this is largely due to not obtaining and following advice from an engineer experienced in judging the adaptability of the various methods of disposal to local conditions and weighing their advantages and disadvantages and comparative costs. As an example of the many things to be considered, take only one method of disposal, hog feeding. An analysis of the feasibility and comparative costs of this plan should not overlook the questions of separating rubbish from garbage that could be fed to hogs, the finding of a satisfactory location for the hog farm, construction of sanitary feeding pens, proper inspection of stock, disposal of uneaten refuse and hog manure, and any and all other considerations important to a garbage hog farm that might be imposed by local conditions.

In other words, in comparing available methods of disposal, each method should be thoroughly analyzed and all the elements entering into a complete disposal scheme should be taken into account in each case. If this were properly done, there would not so often be a breakdown of the system after a short period of operation and reversion to some earlier method.

Unfortunately, garbage disposal is a question into which local politics often enters and ignorance combined with willingness to accept the claims of promoters are outstanding characteristics of the city fathers. One city official recently said "Many of the failures and disappointments in the operation of incinerators have been due largely to the unbounded enthusiasm of the salesman of one or another type of plant and the complacency of city purchasing committees who substitute hope for knowledge." Where such conditions prevail plant inefficiency, breakdowns and abandonments are to be expected. None of these should be charged to the engineer unless he has been a full partner in the proceeding. Rarely is this the case. Occasionally, there is reason to fear, a local engineer almost as ignorant of garbage disposal as the city fathers accepts a position of more or less responsibility in the choice of a method of disposal or the installation of a plant, when common honesty, to say nothing of professional ethics, should compel him to advise the employment of an experienced consulting engineer.

We trust it is clear that we are not accusing the Pacific Coast of dealing with refuse disposal any less wisely or honestly than the other parts of the country. Country-wide reform in this matter is much needed.

Pioneers Unacclaimed

A CENTURY ago there were engineers in the United States. There were bridges being built and lands surveyed; roads were being laid out and canals dug; cities of considerable size existed and the public who lived therein were served. But though these things were being done there was no school where the young man could go to learn how to practice that profession, or craft, then only vaguely known as engineering. To Stephen Von Rensselaer, Patroon of Rensselaerwick, history gives the honor of first recognizing this lack. Borrowing a phase from Count Rumford, he sought to promote the "application of science to the common purposes of life" and in pursuit thereof he founded at Troy in 1824 that institution which bears his name and which for a hundred years has been the source of so much of the inspiration and man power that has made engineering the leader in world progress.

But the centenary of Rensselaer Polytechnic Institute last week, with its deserved tribute to the institution and its founder, brought from academic obscurity two other names that engineers should remember—Amos Eaton, the *de facto* if not *de jure* founder of the Institute and its first director and Benjamin Franklin Greene of its class of 1842 and its director for some years after 1847. Eaton it was who rose superior to his own great talents as a natural scientist to an appreciation of the value of applied science and who persuaded Van Rensselaer of the necessity of a school where science would be taught as a servant of life. Greene a quarter of a century later took the institution Eaton had made and transformed it from a vocational school into a professional college. No small part of the great success of Rensselaer graduates during those stirring three decades after the Civil War was due to the discipline of the curriculum laid down by Greene in 1850. These two men started eras in the development of engineering training. Eaton was the first to breathe life into the unformed ideas that some way ought to be found to formulate instruction in methods of applying the forces of nature to the use of man. Greene was the first to lay down definitely a program for the basic training of the engineer. In its just pride in a long and successful life Rensselaer does well in bringing to the profession's attention these two neglected names.

Engineering education is just now under the microscope. Somewhat too much concern as to its adequacy has been permitted to govern the thoughts and actions of a few of our educators and many of our engineers. The mental poise of these pessimists might be restored by a study of the history of Rensselaer and the performance of her graduates, who were subjected through the century to the régime of Eaton and Greene and Ricketts. A system which has been so successful cannot be very far from right.

Operation Features Stressed by N.E.W.W.A.

Abstracts of Papers and Discussions of New England Water Works Association at Meeting at Rochester, N. Y., on Engineering Questions of Supply and Purification and Many Problems Relating to Operation

At the annual meeting at Rochester, last week, of the New England Water Works Association, the subjects were mainly practical problems of operation and related engineering questions. Abstracts of some of the discussions are presented below. Report of the meeting is given on p. 605.—EDITOR.

An Appeal to Superintendents

BY DAVID A. HEFFERNAN
Retiring President, Milton, Mass.

A CONSIDERABLE portion of your president's time is consumed in making arrangements for papers. I sent out a letter to a considerable number of members requesting that they prepare a paper on some topic of interest, leaving the subject to be of their own choosing. The replies were, almost without exception, from engineers.

Now, this association is composed of two classes of men, superintendents and engineers. The reason for their coalition is that they are necessary to one another. This is as it should be. A combination of the two in one man is ideal but rare. And I want to say now to the superintendents that if we do not take a more active interest in its affairs the association will keep slipping till it is over the brink. We are gainers by our membership through the knowledge we obtain, by what we learn of others' experiences, the difficulties they encounter and how they overcome them.

We must have more papers from superintendents, papers telling of practical experiences. Tell us about how you co-operate with your fire department. Do you ask the advise of the fire chief as to the location of hydrants? Do you receive hydrant rental, and, if so, on what is the charge based? Do you make periodical inspections during the freezing weather or is this left to the fire department? If you maintain them, how do you keep the surface water out, or, if you do not try to, how do you prevent it from freezing? Do you make a point of inspecting hydrants after fires? Of, if your relations with that department are so amicable that they are not interesting or so disagreeable that you can not talk about them without the use of profanity, take some other subject. Tell us about the tools, appliances or accessories that have made your work better or easier.

Do you use a service box finder? Have you any means of determining the location of a pipe if your plans are old or incorrect? Have you a good instrument for finding leaks? Do you use a tapping machine for branches or do you still shut down and "break out"? Have you a valve inserting machine or if it is too expensive did you know it can be rented together with the services of a competent man?

Have you studied (I want to emphasize that word)—have you studied which material makes the best service pipe to carry the particular water you supply? If so, what are you using and why?

Have you accounting methods for keeping your books or do you still maintain a system based on a cash book?

Do you ask your superiors for some large extensions you feel are necessary to the system and when refused because you were not able to make your point clear, eat humble pie, or do you call in an engineer and have him put in words and figures what is in your mind?

* * *

Baltimore County Metropolitan District

BY V. BERNARD SIEMS
Water Engineer of the City of Baltimore, Md.

THE Baltimore County Metropolitan District was recently created at the instigation of the city of Baltimore with power to build, buy or condemn, and maintain and operate water-supply, sewerage and storm-water drainage systems in a large area in Baltimore County surrounding the city of Baltimore. The district, which is the fourth of its general kind in Maryland, was created by the legislature at the instance of Baltimore, in order to provide for the orderly development of the services named in territory likely to be annexed to the city in the future, and particularly to avoid a repetition of experiences in the large recently annexed territory such as paying enormous sums to acquire the property of nine private water companies and then being compelled to make heavy additional outlays to provide adequate water service. Under the act, water, sewerage and drainage facilities in various subdistricts of the Metropolitan District will be financed at the expense of the sub-districts and their residents, and on annexation of these sub-districts to Baltimore the facilities will become the property of that city and the city will assume any corresponding bonds still outstanding. Water supply will be provided from extensions of the Baltimore system and sewage disposal through the Baltimore sewage-works, so far as possible.

The Metropolitan District will be administered by the commissioners of Baltimore. Plans for sub-district improvements will be made under the direction of these commissioners. In the case of water facilities, the plans are subject to approval by the water engineer of Baltimore, but once built the works will be operated by the city.

Taxable property in the Metropolitan District is classified as agricultural, small acreage, industrial or business or subdivision property. Benefit assessments are on the front-foot basis, with no charge against agricultural land until service connections are made, and with assessments then limited to 150 ft. of frontage. The cost of house connections is met by property owners. Water maintenance and operation costs are met by water rates collected by Baltimore. Interest and sinking fund charges on the cost of sub-district water-feeder mains is a charge on the sub-district, the necessary bonds being issued by the county commissioners.

* * *

Present Methods of Water Purification at Providence, R. I.

BY J. W. BUGBEE
City Chemist, Providence, R. I.

THE open slow sand filters put in use about 1904 were covered after the first winter's operation showed the great need of it. In 1917, work was begun on washing and replacing the entire body of filter sand, which had become so permeated with fine material as to cause, so special tests showed, an increasing loss of head from the top down through the entire bed. This was due to the use, originally, of sand specified for an effective size of 0.26 to 0.34 mm., and to following the lower limit closely for the sake of bacterial efficiency. Two of the beds did not require washing, as they were able to maintain rates as high as 4 m.g.d. per acre for considerable lengths of time. By installing water and sand piping and a steam-driven centrifugal pump the working pressure was 110 lb., in operating three ejector-boxes and two washers. A large portable ejector was installed which could handle the output of two ejector-boxes. By this washing the initial loss of head was reduced to less than 0.5 ft. except in the very coldest weather, and the length of filter run has been correspondingly increased without apparent loss of efficiency.

The aversion to chemicals which led to the adoption of slow instead of rapid filters was an obstacle to the introduction of chlorination but was adopted as a safeguard for temporary use during the renovation of the beds. The work took so long that chlorination was accepted as an essential part of the treatment and its use has been continued.

Lime treatment was adopted to reduce carbonic acid after allegations of lead poisoning had been made by a physician in 1918. Although no proof of lead poisoning due to the water supply has ever been brought forward, tests for lead disclosed its presence in amounts of from 0.05 to 0.08 p.p.m., with an average of 0.29 (against the generally accepted limit of 0.5). It has been found possible to neutralize the 8 to 15 p.p.m. of carbonic acid found in the filtrate at different seasons without making the water unsuitably hard for domestic and industrial use. Lime is applied in hydrate form by a dry feeder. During the past year the lead content of the water did not exceed 0.13 and averaged only 0.05 p.p.m.

Copper sulphate was first used in the reservoirs in 1918, when there was more complaint of tastes and odors than ever before. Whenever the weekly microscopic examination shows urogleria present copper sulphate is used, even if the number of organisms is small.

Summing up, present treatment is at the rate of 2½ m.g.d. per acre, with the application of 50 to 100 lb. of hydrated lime and 3 to 8 lb. of chlorine per million gallons, and copper sulphate as indicated. The new Scituate supply will be passed through rapid filters, with alum, lime and chlorine as probable features of the treatment.

* * *

Grouting on Indian Creek Dam of the Pottsville Water Co.

By N. J. Beisel
General Manager and Chief Engineer Pottsville Water Co., Pottsville, Pa.

WATER-BEARING fissured rock extending hundreds of feet below the site of the Indian Creek dam now under construction by the Pottsville Water Co., makes it necessary to drill holes in the bottom of the corewall trench, cement in grout pipes, force in grout, and, in some cases, extend the grout pipes up into the concrete corewall. The grouting pressure is carried up to 80 lb. The grout consisted of 1, 2, and sometimes 3 parts of cement to 10 parts water, no sand being used. An average of 3.36 sacks of cement to 1 cu.yd. of grout was used on the 19 holes grouted up to Aug. 16. The dam will store 480 m.g. of water at an estimated average cost of $1,350 per m.g. Unit prices for this dam are three times those on dams built by the company in 1893-95 and 1906-10. [The paper, which is very long, deals somewhat with the history of the water company since 1834; cites court decisions holding that water companies and municipalities in the coal regions of Pennsylvania can protect themselves against pollution from coal mines only by buying virtually all coal lands in their drainage areas, and therefore may be forced into costly storage developments; summarizes leaks beneath one dam and failure of another built without engineers; and quotes at length from a preliminary report by Metcalf & Eddy on the Indian River dam.]

* * *

Infiltration Galleries of the Des Moines Water-Works

By Charles B. Burdick
Of Alvord, Burdick & Howson, Engineers, Chicago

INFILTRATION galleries paralleling the Raccoon River for nearly two miles supplied an average of 11.8 m.g.d. of water to Des Moines, Iowa, in 1923. The maximum 8-hr. rate was 19 m.g.d. and the estimated peak load was at the rate of 26 m.g.d. The length of gallery in use at the close of the year 1923 was 10,144 ft. The gallery is formed by 4-in. reinforced-concrete rings 4 ft. in diameter and 2 ft. long, separated by ¾-in. lugs. The rings are supported on timber cradles to insure alignment and are surrounded by gravel. The gallery was built in a trench 150 to 200 ft. from the river, with its bottom about 14 ft. below the low-water surface of the river and 25 to 35 ft. below the ground surface.

During the excessive drought in the fall of 1922 land flooding was resorted to for the purpose of increasing the gallery yield. In general, the flooded area did not come nearer the gallery than 100 ft. on the land side. In September, 1922, the land flooding was at the rate of 5 m.g.d. per acre, and during the entire year 1,293 m.g., or 3.55 m.g.d., were used in flooding which was some 35 per cent of the total amount pumped for distribution. The maximum area flooded in 1922 was 13 acres and filtration rate was 0.385 m.g.d. per acre. Flooding was also used some of the time in 1923.

On the basis of the appraised value (in 1912) of the galleries first built and the actual cost of extensions since then, 10,144 ft. of galleries in use at the close of 1923, including about 200 acres of land, was $405,000. In 1923 the galleries yielded 4,300 m.g. The 1923 capital and operating charges are:

		Total	Per M G.
Interest and depreciation at 6 per cent		$24,309	5 66
Operating expense:			
Care and protection of water-supply including laboratory and supervision	$16,285		
Power	3,307		
	$19,592		
Less profit on farm operations	1,736	17,856	4 15
		$42,156	9 81

A 5,000-ft. extension of the gallery, now nearly completed, will cost about $30 per lineal foot.

* * *

Shorter Abstracts

Rochester Water-Works—E. A. Fisher, consulting city engineer, Rochester, outlined not only the water-works system but also the city's sewage- and garbage-works and the conversion of the bed of the old Erie Canal into a subway for rapid transit and industrial railway purposes. John F. Skinner, deputy city engineer, described the three parallel water-supply conduits from Hemlock Lake, which have a combined capacity of about 40 m.g.d., and also the reservoirs of Rochester. The first conduit was mainly of wrought iron, the second of riveted steel and the third of steel with lock-bar longitudinal joints, cast iron being used in parts of all three. Surveys are being made with a view of adding Conesus and Honeoye Lakes to the supply, bringing up the safe yield to 65 m.g. daily.

Syracuse Conduits—Like Rochester, Syracuse has added a second and (six miles so far built) a third gravity water-supply conduit to its original supply main, but all are of cast iron. These and other features of the Syracuse works were described by Marshall B. Palmer, engineer of the Syracuse Water Bureau. The three conduits will have a combined capacity of 30 to 32 m.g.d., which is much below the safe yield of Skaneateles Lake. Mr. Palmer stated that he had been through 10,000 ft. of the first two conduits and found their interior surfaces in good condition and almost entirely free from tuberculation after 30 and 15 years of use. The water supply is now chlorinated all the time, following intermittent chlorination for five or six years.

Continuous Meter Reading and Billing—The meter reading and billing system of Rochester, in use since Jan. 1, 1920, was described by Stephen B. Story, director of the Rochester Bureau of Municipal Research. All consumers are metered; 52,800 small meters are read quarterly and 1,300 large meters monthly. Of late the continuous meter reading and billing are followed. Besides saving congestion of mails by check payments and long waiting lines from the 11,000 consumers who paid their meter bills in person, the continuous plan gets in the money two months earlier than the old plan, and gains for the city some $6,000 of interest yearly. There are ten readers. Each is supposed to make 95 calls daily and gets about 92 per cent of the meters on his list. Three special readers attend to the meters which could not be got on the first call and get 3 per cent more by that means. There are four bill distributors. Delinquents on bills are charged interest at 1 per cent a month.

In discussion, W. C. Hawley stated that his company (in the Pittsburgh, Pa., district) has saved materially by the continuous plan. It has also changed from quarterly to half-yearly billing, but for general protection the meters are still read quarterly. F. E. Winsor remarked that up to some two years ago Providence read and billed yearly, but it changed to a four-district system, which carries the reading through the year.

Chlorine for Respiratory Diseases—Apparatus now in use for chlorine treatment of respiratory diseases by the inhalation of minute quantities of chlorine accurately diluted with the optimum volume of air was described by M. F. Tiernan, president, Wallace & Tiernan, Inc., Newark,

N. J. The chlorinated air may be delivered into a properly controlled room for group treatment, but ordinarily it is far more practicable to conduct the air-diluted chlorine by means of large paper tubes and masks directly to the noses of those being treated, using single or multiple outlets. The apparatus is small, light and readily portable.

* * *

Proceedings on Superintendents' Day

Dean Control Valves—Payne Dean described his electrically operated valve, those under central control and particularly those mounted on motor trucks, now in use by a considerable number of water-works ranging in size from New York City downward. A central-control system for large mains near the Metropolitan Museum of Art, New York City, has been installed for the special protection of the art treasures in the museum, at a cost of $50,000.

Avoidance of Large Capital Outlay—How the Utica Consolidated Water Co. was able to increase its available water supply without capital outlay was told in a paper sent by F. E. Beck, engineer of the company. A half-dozen years ago, an estimated expenditure of $1,099,000 was thought necessary to supplement a 24-in. supply main some 12 miles long. It was decided to see first what a pitometer survey would do. This and other waste detection and correction methods enabled the company to meet the demands for water, although year by year the carrying capacity of the main was decreasing. About 1922, the main was cleaned, and after that it was cleaned again, the two cleanings adding about 3 m.g.d. to the carrying capacity of the main. By this combination the old supply main has been made to serve. Deducting the cost of the waste control measures and of pipe cleaning from the capital charges on the $1,099,000 mentioned above, the methods followed have effected a net saving of $276,000 in six years.

Waterproofing a Leaking Standpipe—Charles S. Beaudry, Lexington, Mass., showed by a lantern-slide talk how "ironite" (mixed with sand and cement) was used on the leaky and badly spalled and blistered concrete standpipe built by Lexington, Mass., in 1912. The structure was in such bad shape that it was a question whether to abandon it or attempt repairs. Finally a contract for repairs with ironite was let. The work required inside scaffolding all the way up the pipe and outside scaffolding much of the way. The inner surface was cleaned, and a plaster coat of ironite, cement and sand was applied. The outer side of the shell, for a long way from the bottom, had a large percentage of its surface either spalled off or blistered ready to spall. The bad areas were cleaned and a coat of ironite was applied. Reinforcing rods were added to the lower 60 ft. of the exterior. Finally, gunite was applied. The leaks have been so largely reduced that it is thought the standpipe may give service for a number of years. The original [pre-war] cost of the structure was $20,000, including $1,000 bonus. Repairs [post-war] prices have added $33,000 to the cost, bringing it up to $53,000. The estimated replacement value of the standpipe is $45,000.

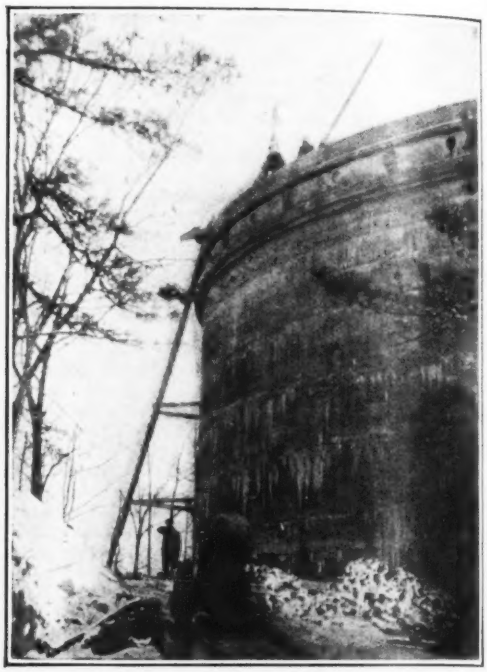
Waterproofing Waltham's Concrete Standpipe—Although every precaution known in 1906 was taken to make watertight the 2-m.g. reinforced-concrete standpipe (100 ft. in diameter and 43 ft. high) leakage developed after a few years, with disintegration and spalling of the concrete. In 1913 an ill-advised attempt at waterproofing by applying a coat of pitch to the inside wall was made. This was of little use. In the winter of 1915-16, and again in the summer of 1917, a coating of cement was applied to the outside of the standpipe with a cement gun, but the seepage and the outside spalling of the concrete kept on, the reinforcing rods becoming slightly exposed at several spots.

In 1922 the writer made an attempt at waterproofing, which, after two years, appears to be a success. After drying the exterior of the standpipe (using a number of salamanders to supplement the natural drying) there were applied: (1) Texaco waterproofing material, hot; (2) waterproofing felt; (3) another coat of the Texaco. This was repeated for five layers, except that the last layer was 6-in. saturated duck fabric, mopped with waterproofing asphalt. Inside of all this a 4-in. brick wall was laid, from floor to top, great care being taken to get a ½-in. course of mortar between the brick and the last course of asphalt.

All material was hauled to the inaccessible site of the standpipe, raised in a pan by means of a boom derrick mounted on top of the standpipe, and lowered through a 4-ft. hole made in the roof of the standpipe. The hoisting and lowering cable was operated by a moderate sized tractor, to the front of which it was attached.

My estimate of cost was $16,500. The low bid for the entire work was $16,543. The general contractor was Simpson Brothers, Boston, who sublet the waterproofing to W. A. Buntfeld Co., Boston. The materials used were: 15 tons Texaco waterproofing asphalt; 150 rolls felt; 550 bags cement; 100 bags lime; 85,000 brick.

The cost of the original structure was about $26,000 (see description by Bertram Brewer in the association's *Journal* for December, 1907).



TRACTOR USED TO HOIST WATERPROOFING MATERIAL FOR WALTHAM STANDPIPE

Fire Hose and Hydrant Spacing—The use of 3- and 1¾-in. fire hose as well as the usual 2½-in. and close hydrant spacing was advocated by W. R. Conard, consulting engineer, Burlington, N. J. With 3-in. hose and hydrants at short intervals it would be possible through six lengths or 300 ft. laid from the hydrant to get 335 gal. of water at 90 lb. hydrant nozzle pressure, as against 235 gal. if the hose were 2½ in. This larger hose would be placed before the water had been turned on, and would not likely be disturbed until the "all out" signal had been given, and empty 3-in. hose is practically as easy to handle as 2½-in. yet 100 g.p.m. more water would be supplied.

A 1½-in. hose 200 ft. long will supply 95 gal. of water at 50 lb. pressure which would be the pressure at the nozzle end of 300 ft. of 3-in. hose with 90 lb. at the hydrant, or within 100 gal. of 500 ft. of 2½-in. with 90 lb. at the hydrant. Therefore it would be possible to siamese the 3-in. to two 1½-in. hose lines either of which could be handled by one man, as against two for the 2½-in., and besides getting within 15 gal. of as much water be able to attack the fire from two points instead of one.

Should the fire assume proportions necessitating the use of 2½-in. hose, there would still be an advantage in having a 3-in. hose laid for say 300 ft. By taking off the 1½-in. hose and hooking the 2½-in. on to the 3-in. and using a single line of the 2½-in. 75 gal. more water would be given than if the fireman was depending on a 2½-in. line all the way from the hydrant to the hose nozzle.

I advocate: (1) That hydrants spaced at a maximum of 200 ft.; and (2) that the hose truck should carry 300 ft. of 3-in. hose, 400 ft. of 1½-, and 500 ft. of 2½-in. hose, together with nozzles for the three sizes and specials for making the various combinations. Then if the pressure is around the 90 lb. mentioned all except the most serious fires can be handled without much pumping apparatus.

Grade Crossings as a Municipal Engineering Problem

Conditions in Several Cities—Much Prospective Work in Separating Grades—Relations Between City and Railroads—Track Elevation Is the Usual Method

THAT SEPARATION of street and railway grades is a municipal problem of wide and growing extent is indicated by the following brief review of present and prospective conditions in a number of cities. Further development of the problem is indicated particularly by the many projects now under consideration and contemplated for the future. Such development may be expected naturally to accompany the growth of cities and the consequent increase of street and railroad traffic in what as yet are border or outlying districts where grade crossings are only beginning to present danger or inconvenience.

No attempt has been made to give a complete list of the cities which are dealing with or facing this problem, but this review represents typical conditions and presents the problems and projects that promise to become of increasing importance in municipal development. It may be noted also that this is a subject peculiarly within the province of the engineer, both as to the planning and carrying out of a grade separation policy.

Extensive Work at Chicago—This city has had by far the most extensive work of grade separation in the central region and was probably the first to undertake this policy on a large scale. The major part of the cost has been paid by the railroads, whose expenditures for this work from 1892 to 1919 aggregated about $93,557,000, divided between some twenty companies. Work of this kind was stopped entirely when the United States entered the World War in 1917, while the financial conditions of the railroads after the war led the companies to plead inability to undertake any of the projects urged by the city.

In view of this situation, an ordinance was passed in November, 1922, requiring all trains to stop at all grade crossings whose elimination was provided for by existing ordinances. The 1923 budget also included an appropriation of $100,000 to permit the Commissioner of Public Works to proceed with such track elevation as he might select, the expenditure to be reimbursed by the railroads, according to a provision in all the track elevation ordinances.

This action led to a conference between the railroads and the city's Committee on Track Elevation, with the result that the Pennsylvania R.R. and the Baltimore & Ohio R.R. agreed to elevate their crossings at Garfield Boulevard and at 56th St. The work was commenced in 1923 and is nearly completed. In addition, other railroads have constructed several subways as required. The Chicago & Northwestern Ry. is now elevating its main line through Mayfair and the Chicago, Rock Island & Pacific R.R. is planning to start its work at 95th St. and Cottage Grove Ave. early in 1925.

Rockford, Ill.—In this comparatively small city, with extensive manufacturing interests, the grade separation problem is complicated by the number of railroads, terminals and industries. The Chicago & Northwestern Ry. is partly elevated and a few streets pass under the Illinois Central R.R. In 1918, a general scheme was submitted to the City Plan Commission, but nothing further was done until early in 1924 when the city engaged E. J. Noonan as consulting engineer. A report is to be made soon on a project based on the earlier plan and designed to develop an economical and comprehensive plan of grade separation in combination with improvement of railway terminal facilities.

St. Paul, Minn.—A city project for track depression on the Chicago, Milwaukee & St. Paul Ry. at West Seventh St. is delayed by litigation, the company claiming that the cost of 22-ft. depression is not justified as compared with elevating the tracks and depressing the street about 7 or 8 ft. The situation has since been altered by the construction of this railroad's new main line cutoff, with spur to the Ford plant, and a proposed new river crossing at Fort Snelling.

Minneapolis, Minn.—A five-year program for track elevation on the Northern Pacific R.R. west from Johnson St. to Lowry Ave. (25th St.) was agreed to in 1923, under an ordinance of 1922. For about half the distance, or from Monroe St. to Johnson Ave., including five subways, the Great Northern R.R. is included, as its tracks are alongside those of the other road. Since the railways are diagonal with the street layout, some of the thirteen subways will be of considerable length and five streets will be closed. One subway was built in 1923 and three are to be completed in 1924, two of these latter crossing both roads. The railroads do all work on the right-of-way and in the streets, including sewer work, but changes in water mains are made by the city and charged to the railroad. The street railway and other public utility companies make the necessary alterations at their own expense.

Grade separation on the Chicago, Milwaukee & St. Paul Ry. between the passenger station and the South Minneapolis shops has been under consideration for some years, but as the city wants track depression while the railroad prefers elevation, the case is now in the courts. An ordinance passed in 1913 called for a 17-ft. depression of tracks, but in 1916 the Federal Court held that this ordinance was unreasonable. The company then submitted plans for track elevation to be done at its own expense and with no change in streets, except where the elevation ran out to grade. But in 1917, the city council passed another ordinance providing for 21-ft. headway, requiring about 10½ ft. of street elevation and a maximum track depression of about 14 ft. This project was halted by the World War and when renewed in 1922 the property owners objected on account of the great cost of adjusting their properties to the altered levels of both streets and tracks. This case is now before the courts. Although plans for track depression were made by the late Mr. Cappelen, city engineer, as required by the council, he did not favor this method, since it would intersect the sewer system and involve great expense to the city.

St. Louis, Mo.—The principal project now under consideration is the separation of grades on the Wabash R.R. from Forest Park to the city limits at an estimated cost of $1,600,000, of which the city will pay $500,000. Here, as at St. Paul and Minneapolis, the matter is now in litigation owing to controversy as to track elevation and depression; the city considers the latter the more desirable through a public park

and high-class residential district, while the railroad prefers track elevation. The case is pending in the State Supreme Court, and the decision will affect the Rock Island R.R. whose tracks parallel the Wabash.

Seattle, Wash.—Comprehensive studies have been made for the elimination of several grade crossings, but topographical conditions make the problem difficult and none of the proposed plans have been adopted as yet. The cost will amount to several million dollars. Closely related to this problem and the plans for its solution is that of improving and unifying the railroad terminals, which is being studied by the city's zoning commission and engineering department.

Portland, Ore.—A viaduct carrying 33rd St. over the O. W. Ry. & N. line of the Union Pacific System was completed recently at a cost of $42,948, divided equally between the city and the company. The 9th St. viaduct over main line and terminal tracks of the Northern Pacific Terminal Ry. and Spokane, Portland & Seattle Ry., including the elevation of the street for several blocks (*Engineering News-Record*, July 19, 1923, p. 94) is expected to be built next year at a cost of $150,000. Two other viaducts proposed to cross railroad tracks will each be about ¼ mile long and cost several hundred thousand dollars. The new Burnside and Ross Island bridges, to cost $2,000,000 and $3,000,000, will eliminate grade crossings of bridge approaches.

Los Angeles, Calif.—In replacing its present surface line along Ocean Boulevard to the harbor, the Los Angeles & Salt Lake R.R. (Union Pacific System) is to build a 14-mile line having no grade crossings.

Dallas, Tex.—Several large projects are developing, the most important being that for entire removal of the tracks of the Houston & Texas Central R.R. (Southern Pacific System) for about four miles, from Cabell St. to the Missouri-Kansas-Texas Ry., and the conversion of the right-of-way into a broad boulevard, connecting the residence and business districts. This will be made practicable by the completion of the new Houston & Texas Central Belt Line. Propositions have been submitted to the city by the railroad, which asks $2,000,000 for property to be abandoned. There are to be no grade crossings on the Belt Line. Another large project, which is now under negotiation between the city and the Santa Fé Ry., is the elevation of the latter's line which traverses the city for about 4½ miles and has numerous grade crossings. The heavily traveled Lemmon Ave., crossing of the St. Louis Southwestern Ry. has been eliminated by lowering the road and slightly raising the tracks at a cost of $65,000, divided equally between the railroad, the city and the county. Plans have been submitted also for the Waller St. crossing on the Missouri-Kansas-Texas Ry. Two similar projects for future consideration are for Maple Ave., on the St. Louis Southwestern Ry., and Ash Lane, on the Texas & Pacific Ry.

Louisville, Ky.—The general elimination of grade crossings has been under discussion for some time, and a few years ago the city prepared plans for the Louisville Bridge line and the Pennsylvania Terminal R.R., from the river to Kentucky St., 1½ miles. Recently, a board of consulting engineers has submitted a preliminary report which is being considered by the railroads; a final report will be made to the Board of Public Works and it is hoped to start construction next year. A bond issue will be voted on in November.

Indianapolis, Ind.—Plans are under way for two projects which will be commenced this year or in 1925 and together will cost about $12,250,000. Of this amount, $10,000,000 is for the elevation of the Belt Line from Prospect St. to West 18th St., including five miles of four-track line, 2½ miles of double track, thirty street subways with connecting retaining walls and seven subways for intersecting railroads. More than fifty industrial spurs will require extensive remodeling to connect with the new elevated line. The railroad will also build a reinforced-concrete arch bridge across White River to replace the present steel bridge. The second project involves ¾ mile of track elevation with five subways on the parallel tracks of the Pennsylvania R.R. and Cincinnati, Indianapolis & Western R.R. between Davidson and State Sts., to cost $1,500,000. The third project, involving $750,000, is for ½-mile of track elevation with four subways and connecting retaining walls on the parallel lines of the Lake Erie & Western R.R. and the Cleveland, Cincinnati, Chicago & St. Louis R.R. from East Market St. to Massachusetts Ave.

Fort Wayne, Ind.—Track elevation is in progress on the Pennsylvania R.R. and the Wabash R. R., both lines crossing Lafayette St. The Wabash R.R. has awarded its contract, including a four-track concrete bridge, to the P. J. Hanna Co., St. Louis. The Pennsylvania R.R. has awarded to the Carmichael-Cryder Co., St. Louis, a $600,000 contract for a 15-track bridge and retaining walls, also new team track and freight-house facilities at Hough St. The entire cost will be $1,300,000.

Cleveland, Ohio—Track elevation is in progress on the Pennsylvania R.R. between Central Ave. and Holton Ave., 1½ miles, including six crossings. The tracks are already raised on trestles and the work will be completed in 1925 (*Engineering News-Record*, Sept. 11, 1924, p. 426). An agreement has been made for a bridge over the New York Central R.R. at E. 152nd St., while the elimination of the crossing at W. 117th St. is under consideration by this railroad and the cities of Cleveland and Lakewood. It is expected to start both of these projects next year.

Akron, Ohio—Track elevation as planned from Center St. to South Main St., on the Baltimore & Ohio, the Erie and the Pennsylvania railroads, includes nine streets, five of which will be lowered and four raised, with street approach grades not exceeding 6 per cent. Revision of the sewer system will be necessary in the southern part of the city. The first section of the work, from Center St. to Exchange St., is expected to be started this year and will be completed before the second section is begun. Another project is the N. Arlington St. crossing of the same railroads. Total cost of these projects is estimated at $5,000,000 of which 66.6 per cent will be paid by the railroads and 33.3 per cent by the city.

Columbus, Ohio—Work involving $2,750,000 is in view. For the elimination of crossings on the Norfolk & Western R.R. in the eastern part of the city, to cost $1,500,000, an agreement has been made, but work is delayed pending settlement with an electric railroad. Negotiations are expected to be concluded and work begun this year on the Dennison Ave. project in the heart of the city, to cost about $1,250,000 and including the Pennsylvania, the Hocking Valley and the Cleveland, Cincinnati, Chicago & St. Louis railroads.

Dayton Ohio—Comprehensive grade separation is included in a ten-year program of improvements prepared by the Chamber of Commerce, but no definite plans have been made. One proposition is for elevation of all existing lines, while an alternative is the relocation of the railroads in connection with a new union station.

Detroit, Mich.—A 15-year program for the elimination of grade crossings was prepared in 1915, at which time the total cost was estimated at $30,000,000 to $50,000,000. Work has been carried on continuously but is not keeping pace with the city's growth. About 55 miles of line is still involved and it is estimated that the program may extend over thirty years unless more rapid progress is made. Within the past few years there has been greater activity by some of the railroads, due to the fact that under present arrangements the city pays 25 per cent of the cost, besides assuming damages to abutting property. Work is in progress at Dix Road, Fort St. West and one intermediate crossing on the joint lines of the New York Central R.R and the Michigan Central R.R. and the parallel line of the Wabash R.R., with an estimated cost of $1,100,000 for the program here during 1924 and 1925. On the track depression of the Grand Trunk Western Ry. (see *Engineering News-Record*, July 10, p. 60), the cost for the same two years will be about $700,000. Except for this latter line the work is mainly track elevation.

Grand Rapids, Mich.—A comprehensive plan for grade separation has been approved by the city and all the railroads; the division of cost is now under consideration. As the first step a street viaduct will be built costing about $309,000; test borings for this have been made.

Income Tax Decision Affects Many Consulting Engineers

Federal Court Rules Consulting Engineer Must Be Regular Public Official to Be Exempt from Income Tax

Full text of opinion in Leonard Metcalf et al. v. John J. Mitchell, collector, Massachusetts District Court of the United States, is here given. The decision was announced by Justice Lowell on May 21. The government has appealed. It is hoped that the hearing on appeal will be held in the latter part of October.

THIS IS a suit to recover excess profit taxes paid under protest. The plaintiffs were members of a firm of consulting engineers who advised various states, municipalities and water and sewerage districts throughout the country as to the installation of water-works and sewerage systems. The manner of their employment and their rate of compensation differed somewhat. They were consulted either on a specific problem, for which a fixed sum was paid, employed on a yearly salary or for compensation based on the amount of work done. In two cases, however, which will be referred to hereafter, their employment was on a different basis. The plaintiffs were assessed the sum of $1,259.26 for the year 1917 as excess profits on this kind of work. They paid under protest, and are now suing to recover. The statute then in force excepted various officers in the following words:

"This title shall apply to all trades or businesses of whatever description, whether continuously carried on or not, except:

(a) In the case of officers and employees under the United States, or any state, territory or the District of Columbia, or any local sub-division thereof, the compensation or fees received by them as such officers or employees." *War Revenue Act of* 1917, 201.

It is contended by the plaintiffs that they were officers or employees within the meaning of the statute. I am of the opinion, however, that the officers or employees contemplated in the exception were regular employees of a state or sub-division thereof, and not persons whose services were made use of as consultants, and who were not in any sense a part of the regular force of such state or sub-division. (*U. S. v. Germaine*, 89 *U. S.* 508; *Sherburn v. Hooper*, 40 *Mich.* 503.)

In two instances the plaintiffs were appointed regular officials of a sub-division of a state. Mr. Metcalf was chosen chief engineer of the Kennebec Water District, which was established to provide a healthful water supply for the inhabitants of the district, and Mr. Eddy was a member of the Board of Engineers of the North Shore Sanitary District in Illinois, appointed under an ordinance for the purpose of protecting the waters of Lake Michigan from contamination. These two instances, in my opinion, come within the exception of the statute.

The further contention as to the greater part of the services rendered by the plaintiffs is that although the plaintiffs were not in terms excepted by the statute, the National Government has no right under the constitution to interfere with the sovereign powers of a state or subdivision thereof when they relate to a governmental function such as the preservation of the public health. In the present state of the law this question must be divided into two parts. In the first place as to the services rendered for water supply. While the provision of water for the extinguishment of fire is a public purpose (*Tainter v. Worcester*, 123 *Mass.* 311; *Brinkmayer v. Evansville*, 29 *Ind.*, 187; *Wheeler v. Cincinnati*, 19 *O. St.* 19) the highest authority shows that the provision of water for the general purposes of the inhabitants of a city or town is not a public purpose (2 Nichols, *Eminent Domain*, 2nd ed., p. 1382). As to the services, therefore, rendered in connection with the provision of water supply or the maintenance and repair of water system, the Government had power to tax, and there can be no recovery.

There remains the question of the tax in connection with the services rendered for sewerage systems. The provision of a system of sewers has been held to be so connected with the public health as to be part of the governmental function of a municipality. (*Johnston v. District of Columbia*, 118 *U. S.* 19; *Child v. Boston*, 4 *Allen* 41, 51.)

The interesting and delicate question remains whether as to these services the National Government has the power to tax when they are rendered by persons not in the employ of the state or a sub-division thereof. It is earnestly and eloquently argued that to allow such a power of taxation would interfere with the sovereign power of the state to look out for the welfare of its inhabitants, and it is further insisted that if such a tax can be levied it might be made at such a high rate as to practically destroy the power of the state to carry on its governmental functions. (See *Flint v. Stone-Tracey Co.*, 220 *U. S.* 108, 157; *Bettman v. Warwick*, 108 *F. R.* 46.) But it is of the utmost importance that the power of taxation of the National Government should not be unduly restricted, (see *So. Carolina v. U. S.* 199 *U. S.* 437, 457) and I am of the opinion that the taxing of the income of private persons, although arising from services rendered to a state, does not so seriously interfere with the governmental functions of the state as to be unconstitutional.

It was ingeniously argued at the bar that the services rendered in many instances by the plaintiff were the same services as those of city or town engineers; that such city or town engineers could not be taxed under the statute, and that therefore the plaintiffs could not be taxed. It was suggested that the statute could be complied with by the simple expedient of making the plaintiffs in every case public officials. This was not done, however, except in the instances which I have mentioned. If the appointment were made clearly as a subterfuge in order to defeat the tax it would not be valid, and the true distinction seems to be that states or public officials thereof cannot be taxed, while private persons, though rendering similar services, may be taxed.

The plaintiffs may recover the amount of the tax paid by them on the excess profits arising from their services in connection with the Kennebec Water District and the North Shore Sanitary District, but are not entitled to recover for anything else.

Redressed Granite Block Paving in Philadelphia

Uniformity of Depth of Block More Important, With Regard to Wear, Than Side Dressing and Joints—Bituminous Joint Filler Gives Satisfaction

By Julius Adler
Deputy Chief, Philadelphia Bureau of Highways

At the close of 1913, there were 348 miles of granite block paved streets in Philadelphia, of which not less than 325 miles consisted of stone blocks laid on several inches of coarse sand, locally known as "gravel" base. Since these pavements were almost without exception in the older sections of the city and in many instances had been in use for periods of 30 years or more, the necessity for their improvement was obvious. The redressed granite block pavement laid on Broad St., north and south of Lehigh Ave., in 1912-13, the first of its sort in the city, was intended to demonstrate the possibilities of at least one available method of improvement.

The contractor for the construction of the first section of the Broad St. Subway in Philadelphia is now removing from that portion of the street known as the "hump" the redressed granite block pavement laid in 1912-13. These blocks had seen eighteen years' service under the heavy Broad St. traffic on a 4 per cent grade before being redressed, relaid and grouted on a concrete foundation. Now after nearly 12 years of additional service, the blocks being removed are found to be too good to be placed in the discard and are being cleaned and stored for possible future use.

Between 1913 and 1919 additional redressed block work was completed in quantity and importance of location sufficient to furnish satisfactory evidence of the merits of this class of paving, but work on a large scale was not undertaken until 1920. In the latter year seven contracts were completed, totaling 5 miles in length, providing for repaving from curb to curb with redressed blocks on 6-in. concrete foundation. In 1921, 23.8 miles of redressed granite block repaving were completed, together with about 10 miles of the same class of work between railway tracks, in conjunction with other types of pavement on the shoulders, and in 1922, the corresponding figures were 24.4 miles and 2.49 miles, respectively. In 1923, due to lack of appropriation for repaving, the amount of this work was reduced to 3.68 miles. During the present year contracts for approximately 30 miles of repaving work have been made, of which about two-thirds of the total consists of redressed block pavement. These figures give some idea of the extent of the redressed granite block improvement program thus far completed in Philadelphia. There still remain in the city possibly 250 miles of the old type of stone block pavement, a great deal of which carries heavy traffic and is obviously not improving in condition from year to year.

Redressed Block Specifications—The first specifications for redressed block work in Philadelphia, arrived at after demonstrations had been made by skilled cutters on typical old blocks, provided for a block 5½ to 6½ in. in depth, about 4 in. in width and 6 in. in length, with suitable allowances for variations and with such side dressing that all blocks should be "substantially rectangular in face" and in general produce side joints not exceeding ½ in.

This type of block at the time was considered most suitable from the standpoint of economy and general character of old material to be encountered. The use of "reheaded" blocks, i.e., blocks redressed to whatever extent required on all faces and relaid in their original position, was considered at the time but rejected as being less desirable than the "reclipped" blocks. Studies of typical blocks throughout the city, made some years later, developed the fact that a larger proportion of the blocks, *when split in halves*, would conform to a requirement for depth variation of 1 in., if the limits were made 5 to 6 in., instead of 5½ to 6½ in. This change was accordingly made in 1921. A year ago the requirements for depth of redressed granite blocks were made the same as for standard granite blocks, namely, 5 in. with a permissible variation of ¼ in. either way. The reasons for the last described change will be discussed later in further detail.

Quality Variations — A better understanding of the conditions surrounding the work will be obtained from a description of the general character of material encountered in Philadelphia during the course of the repaving thus far completed. The blocks themselves vary in size, and especially in length, from street to street and from block to block on the same street. Practically all of them, however, range from 8 to 14 in. in length, with the great majority between the limits of 9 and 12 in. The character of stone varies with the source of supply. Work thus far performed has brought to light granite from New England varying from fine to very coarse grain, trap or similar igneous rock from the belt which crosses Pennsylvania and New Jersey, several varieties of gneiss from Pennsylvania and Maryland and occasional sandstone blocks from various locations. At times the stone is found very much mixed in character within a single block on a given street and frequently the quality of the stone is reflected in the character and amount of wear on the blocks.

The general experience of the city has been that coarse-grained granites have worn to a greater extent and much more irregularly under the old horse-drawn and steel-tired vehicular traffic than other grades of stone. Fine-grained granites and the fine-grained igneous blocks from nearby points not only show less wear, but in general have preserved to a higher degree the original rectangular cross-section of the blocks so that after cutting they require less dressing of the sides and give tighter joints and a better looking pavement in every respect. The fine- and medium-grained stone further cuts with more nearly plane surfaces both on the new head of the block and on the sides than does the coarse-grained material. With certain varieties of granite where the mineral constituents are coarse in grain and unevenly distributed

the new heads of the blocks after redressing are nearly always convex or concave to the extent of possibly ¼ to ⅜ in., and, in occasional instances when a gneissic stone has been encountered, it has been found that none but the most skillful cutters can successfully cut and redress the block. In the case of sandstone blocks, it is difficult to predict the amount of success which will result from recutting without making the actual attempt. With some grades of this material a very satisfactory block can be obtained, while with others the cutting of the blocks exposes marked laminations with a resulting tendency for the blocks to split along these lines. Old sandstone blocks have not yet been encountered in any extensive area on a heavily traveled street, but, in view of the general experience with them, it would be the policy either to transfer them to an unimportant street, or, in an extreme case, to discard them entirely.

In the light of these conditions it may readily be understood that the interpretation of specifications governing side dressing and width of joints frequently requires the exercise of some little good judgment. It is further evident that in many cases a better block is produced on one street by the contractor with less trimming than on other streets where the quality and amount of wear on the blocks are both adverse to a first-class product. The principal difficulty arises from the use of the term "substantially rectangular in face" as applied to the redressed blocks. With a poor quality of stone it is not only difficult to dress a misshapen block to a truly rectangular form, but in some cases the "cobble" or "camel-back" is so pronounced (and in other cases the blocks are worn on both faces as a result of turning) that the resultant *rectangular* block would be too thin for further use. Under such circumstances, it is considered that the practical solution consists in dressing for the full depth those blocks which, after removing one badly rounded surface, are still thick enough for further use. On blocks having both top and bottom rounded by wear, the redressing is carried only part way down from the new face in order to preserve sufficient length after redressing. Old blocks rounded on both faces, and misshapen as well, must of course be discarded.

Depth Uniformity Important—In the inspection of block cutting it is necessary to guard against a natural tendency on the part of the cutter to make no attempt whatever, when a run of poor blocks is encountered, to improve the cross-section, upon the plea that the block is incapable of satisfactory side dressing. On the other hand, on a street where the blocks run better than the average as to cross-section there is sometimes a tendency to overlook the occasional blocks which happen to have rounded surfaces and to confine the cutting effort to meeting the specification for depth. After observation of a number of redressed block pavements subjected to heavy traffic the conclusion was reached that *regularity in depth* of blocks was of considerably more importance in its effect upon the wearing quality of the pavement than the matter of side dressing and its corollary width of joints. Under the old specification, allowing 1 in. variation in depth, none but the most rigid inspection would offset the tendency of the cutter simply to split in half all blocks 9 to 12 in. in length or sometimes between even greater limits of length.

TYPICAL REDRESSED GRANITE BLOCK PAVING IN PROGRESS IN PHILADELPHIA

The effect of this developed in a number of ways: In attempting to pave a shallow block beside a deep one, the paver accumulates an excessive depth of bed or cushion under the shallow blocks. In general the paver demands an excessive amount of cushion in order to pave blocks having a marked variation in depth. Under ramming, the shallow blocks are pressed down to a much greater extent than the deep blocks and the tamper after a little experience learns to "feel his way" through, ramming heavily the deep blocks and touching as lightly as possible the shallow blocks with the result that the bedding is anything but uniform. It was at first the practice on this work to correct most of the results of irregular ramming by lifting with a pair of tongs the shallow blocks after the first coat of grout had been applied, but this practice was considered objectionable from the standpoint that there is no assurance of a solid bed being produced under these shallow blocks. The final and most important result of excessive variation in depth of block is in the effect of heavy traffic, which undoubtedly tends to punch down the shallow blocks and to produce in course of time an irregular surface which suffers more than normal wear.

The present specification under which Philadelphia operates, as previously stated, provides in general for the use of a block 5 in. in average depth with ½ in.

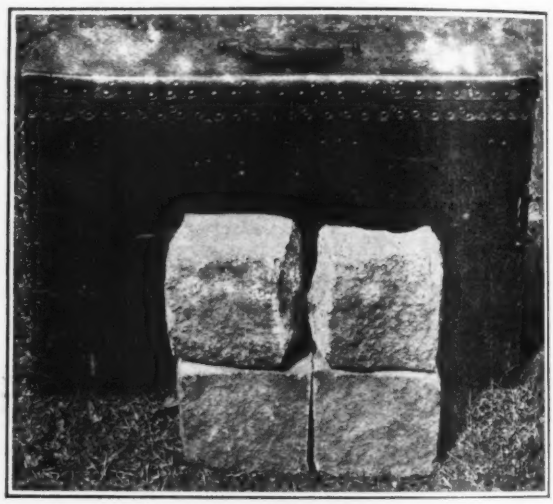
CLOSEUP OF REDRESSED BLOCK BEFORE GROUTING

total variation in depth. The possibility is recognized in the specifications of encountering a considerable area in which the average length of blocks is either longer or shorter than usual—in which case the average depth of redressed blocks is varied to meet this situation—but the requirement of ½ in. total variation in depth is preserved for any given location. Inspectors on this class of work are provided with hand gages usually made for an average 5-in. block so that they can quickly test the depth of doubtful redressed blocks to determine whether they meet specification requirements. The depth of cement-sand bed provided in the specifications is ¾ in. as compared with the earlier 1 in. requirement; as a result of this and the greater uniformity in depth of blocks the former general tendency to excessive amount of bedding material with its consequent evils has been substantially eliminated in the work of the last two seasons.

The only other change of importance in the present specifications as compared with their original form consists of a provision for the use of a "reheaded" block 8 to 10 in. in length to be used adjacent to rails or at the curb in order to break the joints in the paving. In the absence of this provision, it was found that the pavers would either disregard the breaking of joints, or, even more commonly, select unusually small blocks to start alternate rows against a rail, thus creating a weak condition at a point where greatest strength is required. These reheaded blocks are required to have a complete new head or face and such side and bottom dressing as may be required by the condition of the old block for satisfactory paving.

Mastic Joint Filler—A few words relative to the selection of type of joint filler for redressed block paving work may be of interest. During the early period of the city's work, portland cement grout was used exclusively and there was a general belief to the effect that a rigid filler would be necessary in order to compensate for the irregularity in the depth of the blocks and to preserve them to a true surface. The 1921 program, however, included several very extensive stretches of pavement in which bituminous mastic was used on heavy traffic streets. According to the latest observations the surface of these streets is excellent in spite of the fact that the uniformity of depth of blocks was much less satisfactory than under the current city specifications. At the present time bituminous mastic filler is used in all important street intersections; at all locations such as in front of schools and hospitals where a particularly quiet pavement is desired; on contracts of short length where the time of setting of the grout on one shoulder of a car track street would delay the tearing up of the opposite side; and on heavily traveled or similar streets where the exclusion of traffic during the ordinary period of protection of the fresh grout meant great inconvenience.

From the standpoint of the general public the only objection to redressed granite block repaving worthy of mention, as compared with other types of pavement, is the greater length of time during which the street is out of service as a result of the period required for barring out and redressing the blocks, piling them on the footways, grading, concreting and repaving, together with the fact that during this entire period the footways are more or less obstructed by the presence of these blocks. Serious consideration has been given to the possibility of removing the blocks from the street, cutting at another location and returning them to the street at some later time during the progress of the work, preferably after the foundation has been completed and the cement-sand bed spread. For local conditions, however, this is generally impracticable on account of the lack of suitable locations within reasonable hauling distance of the center of the city where this procedure would be of the greatest benefit.



INFLUENCE OF TEXTURE ON WEAR
Fine-grained (lower) blocks give cleaner break and smoother head than coarse-grained (upper) blocks

Conclusion—Based upon the maximum period of twelve years' service of redressed block pavements and the more extensive use beginning with the year 1920, it may be said that this class of pavement has given complete satisfaction. The completed work has met with general popular approval and, in fact, there appears to be a belief in the mind of lay observers of an especial merit in the use of the small blocks as compared to large blocks. This belief, no doubt, is based upon nothing more substantial than the greatly superior riding qualities of the new pavements as compared to the old Belgian block pavements with rough surface, unfilled joints and no foundation. From the standpoint

HOW CHARACTER OF STONE AFFECTS WEAR
Note untrimmed sides of blocks

of those administering the work of street paving the great advantage lies in the large saving effected by the general salvaging of the old blocks.

During the present year the average cost of this class of work, including the barring out and cutting of the old blocks, grading for the construction of the foundation, laying 1:3:6 concrete foundation 6 in. thick and paving and grouting the redressed blocks on ¾-in. cement-sand bed is $4.50 per square yard, which does not include incidental curb and drainage work. This price compares with an approximate figure of $7.25 per square yard for the same construction using new smooth dressed granite blocks. It is, of course, not contended that this entire difference in first cost is pure saving, and that the redressed blocks are in all respects a satisfactory substitute for new blocks, but the advantage in securing a very durable pavement at moderate cost, and in the elimination of larger areas of unsatisfactory pavement when working with limited appropriations, is manifest.

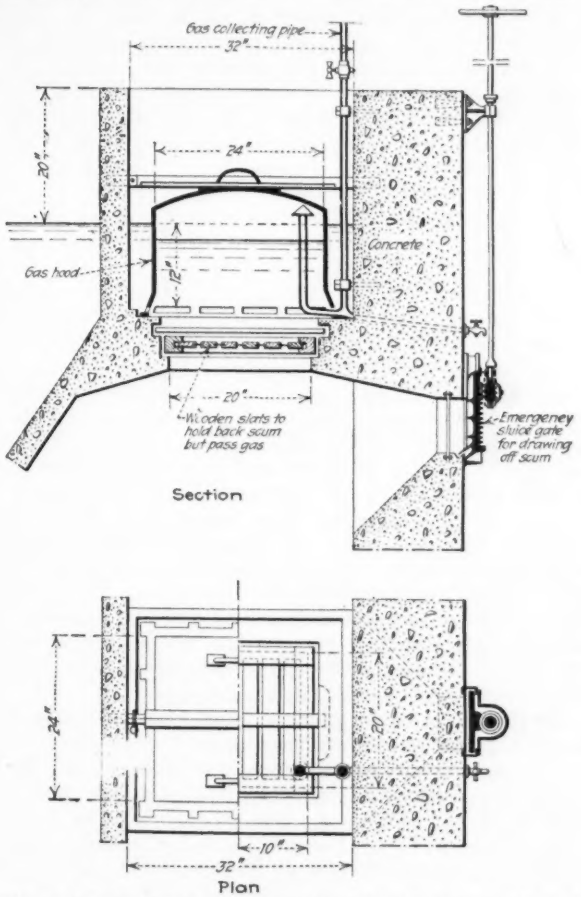
New Design for Collecting Methane Gas From Imhoff Tanks

By Dr. Ing. Karl Imhoff
Chief Engineer of the Ruhrverband, Essen, Germany

Translated from the German by Harold M. Lewis, Executive Engineer, Regional Plan of New York and Its Environs. Mr. Lewis states that he inspected the new apparatus in service during the past summer and that it seemed to be working satisfactorily.—Editor.

THE EARLY gas collectors used in the two-story sewage sedimentation tanks in the Ruhr District, in Germany (described by the writer in *Engineering News-Record*, Sept. 27, 1923, p. 512) were so constructed that the scum reached the surface of the sludge chamber at the side of the gas hoods and could be removed from there. Since then this construction has been improved so that manual labor is no longer necessary (see illustration). The rectangular opening under the gas hood is now closed by wooden slats, fastened together with tongued-and-grooved joints. The gases readily pass through the joints, but the sludge is held back so that it in no place comes to the surface. The gas hood no longer has to be removed.

In most of the plants there is, with this arrangement, no longer any scum, even under the wooden cover. For safety it is still necessary to install an opening with a sluice gate on the side of the tank and below the level of the cover as shown by the drawing. If scum still collects in a large amount it remains wet and fluid because it cannot come to the surface. Therefore it can easily be drawn off by opening the sluice gate and will flow (just as the sludge from the bottom of the sludge chamber does) to the sludge drying beds. This construction also furnishes an absolute assurance against so-called foaming. It is therefore recommended



PLAN AND SECTION OF NEW DESIGN FOR METHANE GAS COLLECTOR FOR IMHOFF TANKS

that it be installed in those American plants where foaming is feared.

This opportunity is used to note an error in the earlier article, already referred to. On p. 514, second column, at the end of the second paragraph, *nitrogen* should be substituted for hydrogen. The entire paragraph will then read:

"By the use of the methods outlined above for the removal of the carbon dioxide and hydrogen from the mixed gas it is possible, according to our experience, to be assured of obtaining a *cleaned* gas which contains 92 to 98 per cent methane, 0 to 8 per cent nitrogen and perhaps some carbon dioxide."

The utilization of methane gas in the Ruhr District has made further strides during the past year. Many additional plants have been connected to the municipal gas works.

Notes from Foreign Fields

Developing Arterial Roads at London

By E. J. Mehren
Vice-President, McGraw-Hill Co., Inc.

WE IN AMERICA are struggling with the problem of relieving traffic congestion in and near our big cities. The Old World, and London particularly, is confronted with the same problem. The solution, we realize, must involve large expenditures, how large we may gather from the experience of London. At the present time, with the financial assistance of the government, the counties about London are engaged in spending £8,000,000 on an arterial road program, involving the building of new roads and the widening and straightening of old ones. Work on 150 miles of road is involved in the undertaking. Some of it is finished, most of the remainder is under way.

Only a general outline of the project will be given here, though some outstanding features in the details will be noted.

Financing—Relief of traffic congestion on roads around London has been under discussion for more than twenty years. In fact, definite plans were formulated as far back as 1912. Necessarily, the Great War prevented their execution. Not until 1920, therefore, was work actually undertaken and then primarily as a means for finding work for England's great army of unemployed. Sir Henry Maybury had been made director general of the Roads Department of the Ministry of Transport. He suggested that these plans, long in abeyance but recognized by highway authorities as thoroughly sound, be among the projects included in the government's unemployment relief measures. The original plans were again studied and modified to meet conditions where they had changed, and the work was begun in 1921. Parts of the system are now under traffic and most of it will shortly be completed.

The project is being financed jointly by the national government, by the county councils of London, Middlesex, Essex, Kent, Hertfordshire, and Surrey, and by certain local authorities. The national government contributes 75 per cent of the cost of the roads in most cases. When a county, however, desires to restrict employment on the works to its own residents and thus relieve, to a greater extent, its own unemployment situation, the government contribution is decreased to 50 per cent. The funds for the government's share come from the motor vehicle, the horsepower tax in England yielding over £15,000,000 annually.

Layout and Width—The layout of the new highways, some of them widenings of existing roads but most of them on new locations, is shown on an accompanying plan. Two special features should be noted: first, that, in addition to the radial routes, these are two circular roads to enable traffic to go from one arterial road to another without entering the area of maximum congestion, and, second, that bypasses, by which main routes are carried around small centers of congestion, are extensively used.

In general, the width of the new roads is 100 ft. between property lines, with a 25-ft. set-back for buildings, giving a 150-ft. street. On some widening schemes and through certain congested areas it has been necessary to be content with 80 ft. On the other hand, the Great West Road in Middlesex (constructed under the direction of A. Dryland, the county engineer, whom many American engineers met when he visited the United States three years ago) has a width of 120 ft. between fences.

On the earlier sections of these roads the carriageway was 24 ft., but the Ministry of Transport has now concluded that the proper unit width for a traffic lane is 10 ft. The later specifications, therefore, call for 30-ft. carriageways. As future traffic demands it, the pavement will be widened to 50 ft.

There are some variations from these widths. In some cases the initial construction has consisted of two 24-ft. pavements separated by a grass area for a tramway, while the Great West Road has a 50-ft. carriageway.

Pavement—Asphaltic construction has been favored for most of the work. Some of it is on concrete foundation and some on broken stone and "hard-core" base. But every year concrete as a wearing surface is finding greater favor with British engineers. It is being used on 41 miles out of the 150 in the arterial scheme.

The bituminous construction on "hard-core" emphasizes the British care with foundations. On the shaped subgrade are laid 3 in. (rolled depth) of cinders—a practice seemingly universal in England where clay subsoils are encountered, and to which the writer called attention in articles on British practice in 1920. The cinders effectively stop the clay from working up into the sub-base. On the cinders goes a 9-in. consolidated layer of "hard-core"—old brick and chunks of concrete hand packed and rammed. On this are 3 in. of water-bound macadam, topped with 3 in. of clinker asphalt, laid in two courses.

Where a concrete base is used, equal care is taken with the foundation. The 9-in. reinforced-concrete slab on the Great West Road, for example, has the same 12-in. foundation of cinders and "hard-core." The surfacing is 2 in. of rock asphalt.

Cinders Again—The use of cinders deserves emphasis again as a cardinal element in English road practice. The writer found them used generally where clay subsoils are encountered, even under concrete slabs. The Great West Road is not exceptional in this respect. Often the concrete is laid directly on them. English engineers believe that clay disintegrates or weakens concrete; therefore the precaution is taken to "smother" the clay with a bed of clinker.

Concrete Details—The mixtures used for the concrete are practically the same as ours: 1:6 (our 1:2:4) for base, and 1:4 or 1:4½ (our 1:1½:3) where the concrete is to be used as a wearing surface. Reinforcement was used in the roads the writer inspected. The thicknesses were both 8 in. and 9 in. In one case two-course construction was used.

On one concrete job the slab was being laid in alternate bays 12 ft. wide running diagonally—at an angle of 60 deg.—across the road. The 60-deg. angle prevents the wheels from hitting the joint at the same time, while the alternate scheme of laying was adopted to reduce the resistance to expansion. The frequency of the joints likewise gives greater freedom for expansion. Both details are attributed to the difficulties which have been experienced from bulging and shattering.

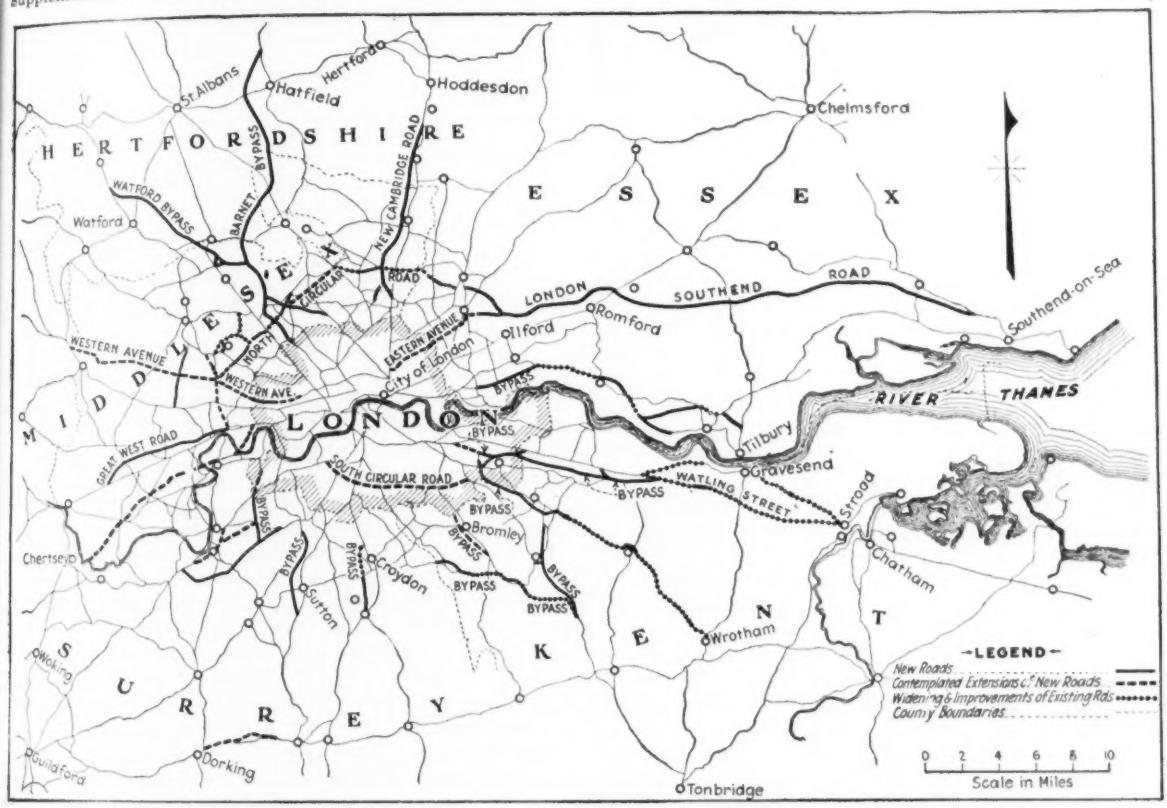
Utilities—A very desirable feature was pointed out on one of the jobs in connection with the laying of

mains. Under the Parliamentary authorization the carriageway may not be disturbed. Consequently all mains are in the grass margins or under the sidewalks. On this road also (the Great West) all mains at crossroads are carried in subways. One of these is 33 ft. wide and carries, among other lines, one 42-in. and two 66-in. water mains.

Orbital Road—The plan herein described is to be supplemented at a later date by a transverse route which will intersect all of the highways from the north and thus allow traffic to be diverted at a distance from the city without coming into even the semi-congested area. This route, to be known as the "North Orbital Road," is to lie in an arc about 20 miles from the center of London. Its location is not shown on the accompanying map. While the construction of this orbital road is not to be taken in hand at once, the land for it is being secured. Experience with the present program has shown that the cost has been very considerably increased by the long delay between the making of the plans and the beginning of construction. Houses had been erected on the proposed lines for the new roads and land values had appreciated materially, thus increasing greatly the acquisition costs.

In connection with these acquisition costs, mention should be made, too, of the present English law which requires that, before a dwelling is demolished, a structure for housing the same number of people must be erected as a substitute. This law is a reflection of the very great shortage of dwellings in England. At the present high cost of building, this regulation also has tended to add to the cost of the present road development program.

Credit—Credit for the progress on the arterial road program is to be given, in the first instance, to Sir Henry Maybury, director-general of the Roads Department of the Ministry of Transport, for to his earnest advocacy is attributed the government's participation in the project. Without that support—predicated, of course, on the desire to mitigate the unemployment—the program would be materially smaller. Direct supervision of the work for the Ministry of Transport is under A. J. Lyddon, chief engineer of arterial roads. The counties act through their county engineers.



ARTERIAL ROAD PROJECT BEING CARRIED OUT AT LONDON

Note that the new roads avoid the towns and that much of the new construction consists of bypasses on existing roads in order to carry traffic around points of congestion. None of the present roads is to be abandoned.

To Investigate Slippery Roads in England

A committee has been appointed by the British Ministry of Transport to investigate the slipperiness of certain types of road. Especially, the Great North Road is, according to frequent complaints of users, dangerously slippery after a rain or a heavy dew. Examination of the surface has shown it to be too rich in bitumen, and it has been decided to recoat sections of the road with a poorer grade of bitumen with as much granite chippings as the material will absorb. This has been held to be insufficient for general purposes, and the committee is making investigations and experiments on other materials. As the government proposes to spend £8,000,000 on the reconstruction of the main roads throughout the country this winter this question of surface materials that will not develop slipperiness is of importance.

Winter Construction

As the Contractor Regards It

II. PROCESSES AND PLANT

Changes in Structural Types and Materials and Improvements of Construction Equipment Simplify Winter Work.

The Second of a Series of Four Articles

By C. S. HILL
Associate Editor, Engineering News-Record

THROUGH improved technique of construction the contractor now regards winter work as a reasonably certain operation. In a generation the art of construction has improved beyond the measure and recognition of the general public. This improvement exists in structural types, in equipment, processes, materials and protective measures. Today the contractor is a confident winter builder. Innumerable completed structures can be pointed to in proof but the situation deserves a more extended explanation.

Structural Types—Steel framework and reinforced concrete are the outstanding structural type developments of modern practice. Both have contributed to the possibilities of cold weather work but in different ways. Concrete as it goes into the structure and gains structural integrity is not a good winter construction material. Fundamental and adaptable methods and readily applicable protective measures make it a practicable winter material. On the contrary, in its nature and in the form in which it is produced and put up, steel framework is a notably perfect material for cold weather. It is the primary structural type development which has increased the contractor's ability to build in winter.

Steel framework is directly serviceable to the contractor for winter operations for the reason that it comes to the work in fabricated units which have only to be assembled on the job and then are immediately of full structural strength. This immediate structural integrity gives in high perfection the indirect winter construction advantage of support for scaffolds, temporary shelters or permanent walls and floors. These direct and indirect qualifications of steel framework for winter construction are demonstrated in the common practice of building both steel-frame buildings, steel bridges or any other steel structure in winter.

The general confidence of contractors in the practicability of structural steel work in winter is indicated in the statement of J. Reid Kilpatrick, of the George W. Fuller Co., that: "In structural steel work there is no particular winter problem. The work may be interrupted by snowstorms but the quantity of work a man does is not restricted by temperature. The opinion has existed that steelwork in winter is particularly hazardous on account of the ice and snow. I have investigated this and found that there is really no difference."

Turning to other structural types in their relation to ease of winter construction, it is observed that such advance as is shown comes from improved materials or methods. This is true even of reinforced concrete which, next to steel framework, is the most important modern structural type development. There has been considerable advance in mill preparation of lumber for exposed timber construction and this has helped out the carpenter in winter work; the situation will be more fully presented later in discussing form construction. In brick and stone masonry any advance in ease and certainty of winter work is due to methods, tools, materials or protective measures.

Equipment—In no respect, perhaps, has the contractor been so much aided in his ability to work in winter as by wide invention and improvement in construction equipment. Let us look at a single illustration. Without the modern highly improved hoisting machine and the pneumatic hammer, steel framework would have fallen considerably short of its present possibilities of being successfully prosecuted in winter.

It is practicable to consider only broad phases in equipment development as it has affected winter work. Machines and even types of machines are too numerous to be considered individually. The phases are (1) Size and power, (2) mobility, (3) mechanical perfection and (4) special-purpose machine invention. Instructive data on all these subjects and particularly valuable data on the historical-mechanical growth of outstanding types of construction equipment are contained in the series of articles in process of publication under the title "Construction Equipment—Past and Present," *(Engineering News-Record:* Rock Drills, April 24, 1924, p. 745; Power Shovel, May 1, 1924, p. 785; Concrete Mixer, May 8, 1924, p. 828; Hoisting Engine, May 22, 1924, p. 916; Surveying Instruments, June 5, 1924, p. 994; Road Grader, July 10, 1924, p. 81.) The present consideration is entirely with the influence of equipment development on winter work. The facts of increase in size and power, improved mobility, greater mechanical perfection and multiplication of special purpose machines are given in that series of articles.

Increase in size and power aids the winter builder in a number of ways:

1. Larger shop-fabricated units can be handled, as in steel erection and form construction, thus reducing manual operations in the field.

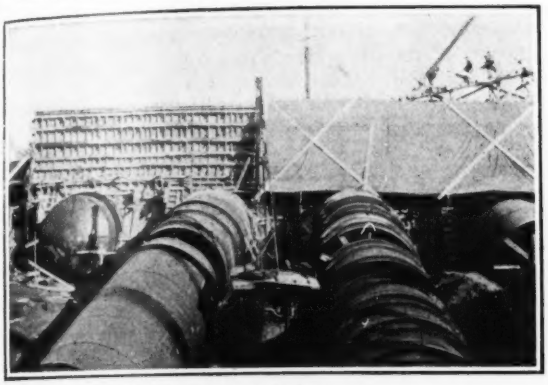
2. In concrete work larger containers, buckets and cars conserve the temperature of heated concrete.

3. In excavation the heavier shovels readily dig frozen ground and with motor trucks, larger cars and more powerful derricks the frozen earth and rock can be loaded and hauled in larger pieces and so reduce secondary reduction in pit and quarry.

In the matter of power advantage comes, as indicated, from larger units and in addition from the extension of the choice of power unit to gas engines and

electric motors. Compared with steam engines either unit cuts down haulage at the time when job roads are at their worst, and reduces the number of men serving fuel to equipment.

Independence of winter road conditions is increased



PENSTOCK HEADWALL COVERED WITH TARPAULINS

Despite severe cold weather in northern Wisconsin this headwall was safely concreted under cover.

by tractor-hauled and traction-mounted equipment and industrial railways. In particular, the crawler traction for both tractors and traction mounts has materially reduced the winter obstacles, to shifting machines and moving loads, of snow, ice and mud. In special service equipment, besides the devices designed particularly for winter, like heaters, housing units and coverings, direct action reduces attendance. Mechanical perfection, always an asset, is particularly one under the increased operating hardships of frost and storm.

Summed up in a sentence, the present high development in variety, power, mobility and mechanical perfection of construction equipment reduces the necessary human element in winter construction.

Processes and Protection—In methods of winter construction, including protective measures, a rather complete technique has been developed. It is however more advanced for some operations than for others. Consideration is therefore best given by discussing types of operations separately.

Masonry Construction—Concrete construction in winter presents the single extra task of keeping the mixture unfrozen until it is in place and has set. Practice has developed very effective methods employing warm mixtures, heated forms, coverings and housing. By any or all of these methods, as conditions may require, the contractor can guarantee unfrozen concrete with a reasonable expenditure (1) in massive structures at any temperature and (2) in thin walls at temperatures ten to twenty degrees below freezing. Canadian contractors have regularly put in mass concrete at 30 deg. below zero. Virtually there is no mechanical limitation to winter concrete work except where the exposure is exceptional as in thin walls and slabs.

With the modern hanging scaffold curtained to protect the men, bricklaying and tile and stone setting are regularly carried on at from 6 to 10 degrees below freezing. New York building contractors of wide experience in winter bricklaying name 20 deg. F. as the lowest safe temperature for bricklaying.

Excavation—Ordinarily, winter puts no considerable mechanical limitations on excavation in the dry. Persistent frost may stop hydraulic fill and dredging in icebound waters. Power excavation, explosives and service railways meet the conditions of frozen ground as they do those of rock excavation. Clearing tracks from snowfall is about the only extra task. In Canada the snowplow is not an unusual item of equipment for a winter construction operation requiring much service railway. Concede shelter and there is no considerable obstacle physically to winter excavation. Cost limitation is another matter, as the next article will show.

Erection—Steel-frame erection as previously stated suffers little hindrance in winter. This is also true of form erection where shop fabrication in sections is planned and there is power equipment for assembling the sections. Development of the field sawmill and carpenter shop has made form construction a comparatively easy winter operation. The same means is being utilized to cut down the field carpentry in setting up falsework and timber service structures.

In general, processes and shelter have been so well perfected that only a few operations are incapable of being carried out in winter at costs which are reasonable. Shelter and heating in particular have made building construction as safe and certain in winter.

Materials—Steel and cement are new materials which have chiefly advanced the possibilities of winter construction. Lacking these, wood and stone and brick

CANVAS COVERING FOR WINTER CONCRETING

Winter progress on 14-story reinforced-concrete hotel in northern Indiana made possible by use of inclosure. Exterior was stone and brick.

are as they always have been. With steel and cement as co-ordinate materials the possibilities for winter work of the older materials are enlarged. With the steel frame which carries the stone and brick walls, partitions and floors as the human skeleton carries the flesh, brick and stone work become stable under the

effects of freezing and thawing when in the old self-supporting wall their use under the same conditions would be hazardous. Portland cement also gives a quicker strength-gaining mortar for winter masonry, and the new aluminate cement offers possibilities along this line that have not yet been fully tried out.

There has been a gain to winter construction also in new forms of manufactured products of various materials as precast concrete units, wall and floor tile, partition blocks, mill-fabricated wood and metal building units, and plaster board. All these reduce the requirements for heat protection of construction.

BRIDGE PIER CONSTRUCTION IN CANADA IN WINTER

Protecting the forms and heating of materials were the processes used.

Summary—Even so brief a review of the changes in the art of construction reaffirms the conclusions:

1. Technically the contractor is prepared to do most kinds of construction work in winter with certainty of success. This leads to the further conclusions:

2. The human element—ability and willingness to endure cold and storm—sets the limit to the usefulness of mechanical methods and

3. The handicap due to the human element is a direct function of exposure.

In brief, we return ever in considering winter work to the questions of labor and weather. The Hoover committee report sums up well the technical aspect of winter work as follows: "Climatic handicaps which limit the construction season operate primarily and directly on the human element. In general, any material, method or equipment which decreases human labor and *exposure*, or which substitutes for man power primary power in more efficient or powerful form; or which enables building work to be planned with greater skill and certainty, operates to extend the limits of the working season. There have been tremendous strides along these lines in the last three decades."

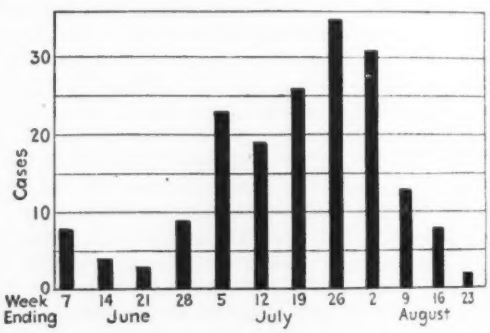
Combatting Exposure—Exposure as understood by contractors has a significance beyond the dictionary definition. It is a function of locality, of kind of equipment, of nature of operation and of structural form, all regardless of general climate. It is one thing on an open plain and another in a sheltered valley. It is one thing when housed in a steam shovel cap and another when riding a tractor. It is one thing in driving a tunnel and another in erecting a standpipe. And, important as any, it is one thing when the structural form is a thin concrete slab or wall and a different thing when it is a massive footing. Emphasis has been put on these obvious facts because it is important to comprehend that exposure, the most influencing factor in winter construction, is as the contractor must regard it, a specific, individually definite condition and not a climatic generalization.

Combatting exposure is the essential winter task of the contractor. His equipment, his methods, his job planning for winter operations are built up on the theory of counteracting exposure. The technique has been highly developed and merits study.

[*The first article of the series was published October 2, 1924, p. 532. The third article will discuss "Methods and Costs."*—EDITOR.]

Heavy Typhoid at Knoxville Attributed to Milk and Spring Water

A NUMBER of cases of typhoid fever in Knoxville, Tenn., in June, attributed to milk from one dairy, were followed by a much larger number of cases thought to have been due to drinking spring water because of its greater coolness in warm weather. A total of 181 cases were reported from June 1 to Aug. 23, inclusive, although it is thought probable by Dr. Marvin F. Haygood, health officer of Knoxville, that some of these were paratyphoid. The accompanying diagram shows the weekly run of the cases reported. Dr. Haygood says that the warm weather led to an "irresistible desire on the part of many of our people to drink copiously from our numerous springs in and about Knoxville, where the water ranges from 57 to 59 deg. F." He adds that analyses of water from 54 of these springs resulted in finding B. Coli in all but seven. As found, the dangerous springs were placarded with an 11x14-in. poster, carrying, printed in red ink:



TYPHOID FEVER AT KNOXVILLE, TENN.

Warning!! You Drink This Water At Your Own Risk. It Has Been Analyzed By The City Bureau of Health And Found To Be Dangerously Polluted. Don't Drink It. City Board of Health.

Dr. Haygood thinks little heed was paid to these.

On July 25 the local newspapers were supplied with a bulletin advising immediate anti-typhoid inoculation, that city water only be drunk, that no milk be used except as recommended by the health officer, that there should be no bathing in any public pool or river, that flies and their breeding places be destroyed, and that sanitary conditions about the home be improved. On July 30 there was engaged an epidemiologist, Dr. George T. Wilhelm, of the University of Tennessee, and two unofficial health organizations volunteered their service to aid in the control of typhoid. The number of cases recorded during June, July and August of this year were little if any higher than in earlier years.

Notes on Garbage Disposal Methods in Pacific Coast Cities

Methods Vary Widely—Some Sell Garbage, Others Pay for Disposal—Fills, Destructors and Hog Farms All in Use

OBSERVING the wide divergence that obtains in Pacific Coast cities in the disposal of garbage and other refuse, and in order to collect under one heading data for a basis for comparing the situations that now exist there, a résumé of refuse disposal methods used in some of the chief cities of that territory is presented in the following:

San Francisco, Calif.—There is no separation of garbage or "swill" from other refuse except by hotels and restaurants which sell this garbage for about $3.50 per ton to hog raisers. All garbage and other refuse placed in garbage cans by householders is collected by licensed scavengers. A city ordinance places a limit on the rates to be charged householders and apartment houses, the rates being based on the number of rooms and, in certain cases, the floor on which the rooms are located. Scavengers deliver refuse to a Thackeray destructor which was built in 1896 and which has operated continuously since that date except for a brief period required to repair damage caused by the disaster of 1906.

In 1910 the city contracted for two English type incinerators, but only one of these was built, and this one was never accepted by the city engineer and has stood idle since its construction (*Engineering News-Record*, June 19, 1915, p. 777). Since 1918 the Thackeray destructor has been operated by the Scavenger Co-operative Association which has collected $1 per ton for all refuse delivered. This charge is expected to cover the actual expense of operating and maintaining the plant. The Public Health Department and the Board of Public Works exercise a general supervision over conditions of operation.

The Scavenger Co-operative Association collects a total of 10,500 to 15,000 tons of garbage per month, according to the season. Taking a 25-day average month, this gives a total of 460 tons per day from an estimated resident population of about 680,000. In making any analysis of these figures it must be remembered that San Francisco, like the Borough of Manhattan, is in large measure a business center for people whose residences are outside its boundaries.

Sacramento, Calif.—California's capital city, with a population of 66,000 (1920), has a municipal garbage collection system, under which a charge is made to the householder based on the number of rooms in his dwelling or apartment. The city has been disposing of the garbage by hog feeding, but more recently has built an incinerator of the F. L. Decarie type. This change was made because it is believed that a site suitable for a permanent hog farm cannot be found within economic hauling distance of the residential district, and because a considerable revenue is expected from the bottles, papers, rags, and metal which are to be salvaged from the garbage before it goes into the incinerator. (References to garbage collection and disposal in Sacramento were published in *Engineering News-Record*, April 26, p. 742; June 14, p. 1062; Aug. 2, p. 181; and Aug. 23, p. 307, all in 1923.)

Los Angeles, Calif.—Los Angeles, perhaps because of the fact that for many years its garbage has been fed to hogs or treated by a reduction process, is one of the few western cities which have succeeded in educating their citizens to separate garbage from other classes of refuse. The separate cans for garbage and for non-combustible rubbish must be set out on the curb by the householder at stated hours. The city collects garbage and non-combustible refuse without charge, using both teams and motor trucks. Combustible refuse is not collected by the city and if the householder puts paper or other combustible in either the garbage or the refuse can, scavengers are instructed to leave the entire can untouched. Private individuals that contract for the collection of combustibles do a considerable business, particularly in the downtown district.

The city's garbage and non-combustible refuse collection cost for the last fiscal year available when these notes were taken was $3.71 per ton. The amount collected which was classed as green garbage, and this includes collection from hotels and restaurants, was 93,723 tons, or an increase of 40,000 tons over the year 1919-20. This garbage is sold under contract to a private company operating the Fontana hog ranch, the ranch owners paying the city 60c. per ton f.o.b. Pacific Electric cars.

For several years before the present system of disposal was put in use the garbage was treated in a privately-owned reduction plant; before that it was fed to hogs by a private contractor; still earlier, the city burned it.

Los Angeles rigidly enforces the ordinance prohibiting anyone other than city scavengers from transporting garbage through the city streets and has successfully defeated attempts of restaurants to overthrow this ruling even though in some cases restaurant owners were operating their own chicken and hog ranches and were making effective use of their own garbage at the time the ordinance went into effect.

Spokane, Wash.—The city of Spokane, with a population of about 105,000 and about 26,000 residences from which garbage collection should be made once or twice a week, has been facing a rather serious situation in that garbage was collected by city scavengers (when these notes were made) from only 12 per cent of the residences. This service is rendered for a minimum charge of $1 per month for a 30-gal. can but, as shown by the figures cited, has not proved popular. A campaign was waged early in the fall of 1923 to secure approval for funds that would enable the city to care for the garbage if an ordinance were passed under which it would be compulsory for householders to use the city disposal system.

To care for all the garbage of the city would cost about $200,000 at the outset, of which $160,000 would be for collection and disposal the first year and the remainder for new equipment. After the first year, the yearly cost would be about $155,000. These figures are based on complete free collection by the city under compulsory ordinance. The garbage collected by the city scavengers is delivered to an F. L. Decarie incinerator with a capacity of 50 tons per 24 hours, which can be crowded up to 85 tons with the use of a blower.

Collection experience in Spokane indicates that a truck with three men is more economical than a truck

with two men. The city has been operating five trucks with two-men crews and three trucks with three-men crews. The latter can cover a given route in two hours less time than the former. Under Spokane conditions a rough basis for figuring garbage quantities is that there will be a ton a day from every 1,000 inhabitants.

The incinerator handles 35 tons per day in summer and as low as 16 tons in winter. The hotels and restaurants sell swill to hog raisers.

Portland, Ore.—The garbage in Portland (population 260,000 in 1920) is collected by licensed scavengers who choose their own routes and make their own rates to householders. Restriction is placed on them as to disposal; that is, they must deliver garbage to one of the two municipally operated dumps or to the incinerator, no charge for disposal being made in either case. Until recently the only means of disposal was the incinerator, which was built in 1911, and this meant that from the more remote districts a haul of 8 to 9 miles was necessary. Since establishing the sanitary fill method of disposal, patterned after Seattle practice, the maximum haul does not exceed six miles. About ninety trucks and four horse-drawn wagons are used.

Several years ago Portland authorized a $200,000 bond issue for the construction of another incinerator, but it decided "to let other cities do the experimenting in that line and to depend on the sanitary fill method until the whole question of garbage disposal is worked out and understood more thoroughly."

The Portland incinerator is of the Fred Smith type, with a rated capacity of 150 tons per day. It has handled as much as 25 tons per hour, and on occasion 218 tons in 24 hours. Exclusive of interest and depreciation on the plant, the cost of operation of the destructor has been about 52c. per ton. Anyone with garbage or refuse to dispose of is permitted to bring in the waste material and dump it on the incinerator charging floor. Even the sawmills are allowed this privilege and use it to a limited extent for the disposal of mill refuse.

Since the establishment of the sanitary fills, the destructor does not operate continuously, being shut down whenever the deliveries drop below a minimum figure as the economic operating limit. In wet weather, or when other conditions at either of the fills preclude disposal there, the destructor is put in operation.

The men stationed on the charging floor separate, to a limited extent, the material delivered for incineration. Barrels, crates, and other wood are thrown down chutes to the stoking floor below. Drums for oil from garages are kept on the charging floor, so that oil can be added to aid combustion as needed. A limited amount of sawdust, mill waste, and other inflammable material is also stored by dumping it down a chute to the stoking floor where it is used as an aid to proper combustion when needed. Fuel of this sort is useful when spoiled fruit is brought in from the canneries in very large quantities, or when, after a stable or dairy fire, several dead animals are brought in for incineration at one time.

When the sanitary fill plan was started in Portland, the Park Commission was planning a 40-ft. fill in Dunaway Park. Arrangement was therefore made with the sanitary department whereby the Park Commission pays contractors 10c. per cubic yard for earth delivered in stipulated quantities on this fill. Schedules are so arranged that this earth is sufficient to cover the garbage adequately at the rate it is normally delivered to this site. About 2 cu.yd. of earth are put in for every cubic yard of garbage. The depth of the fill at first is being made 25 ft. The remaining 15 ft. will be added later. In fact, a depth as great as 25 ft. was considered practicable only in view of the high percentage of earth available to supplement the garbage. The objection to high garbage fills, the Portland engineering department holds, is that sloughing of the face of the fill at night when no attendant is present uncovers the raw garbage and objectionable odors escape.

When the incinerator is shut down, thus diverting a considerable amount of garbage to this fill, four to six men are employed there shoveling earth, moving planking, etc. It costs about 31c. per ton to dispose of garbage on this fill, exclusive of the 10c. per yard paid by the Park Commission to the contractors.

Another garbage disposal site, known as Fremont fill, is located in an abandoned gravel pit where the fill could be carried to considerable depth by the successive use of 10- or 12-ft. layers. The cost of operation at this fill during 4½ months averaged 38c. per ton. A considerably less yardage of earth has been used here than in the case of the Dunaway fill.

On neither of these fills is there any burning, for fear that there will be complaint from the odors of combustion. When the wind blows from the fill toward residential districts, care is taken to spray uncovered garbage with a pinoleum preparation to prevent odors (*Engineering News-Record*, Oct. 4, 1923, p. 560). Workmen at the fill are instructed to guard carefully against oily rags on account of the danger of spontaneous combustion. Trucks dump throughout the day along a 40- to 60-ft. length of 12-ft. face. After 4:15 p.m. no further garbage is accepted and the remainder of the working day is used to cover the face of the fill with earth.

Seattle, Wash.—This city has built and abandoned three high-temperature British type destructors and for seven years has been filling depressed areas with garbage covered over with just enough earth to prevent unsanitary conditions. How successful this has been is shown by the fact that the health department continually has on file more applications from property owners who desire fills made on their land than can be accommodated with the amount of garbage available. The summer quantities are about 400 tons per day, increasing to about 500 tons per day in winter. The Seattle health department estimates the cost of operating its sixteen fills at 30c. per ton compared with $1 per ton for incineration. A detailed account of Seattle sanitary fills was published in *Engineering News-Record*, Nov. 23, 1922, p. 876.

About 25 tons of swill per day are collected privately from Seattle hotels and restaurants and fed to hogs. Several thousand hogs are maintained by the company operating the hog farm and some interesting experiments in methods of feeding are under way.

Furnishes Residence for Its City Manager

Besides paying its city manager a salary of $12,000 a year, the city of Lynchburg, Va., supplies him with a residence free of charge. The present incumbent of the office, E. A. Beck, has just been reappointed by the incoming city administration, his new term of office to be six years. He became city manager of Lynchburg in September, 1920.

Municipal Improvements Discussed at Convention

Chief Topics at Boston Meeting of American Society for Municipal Improvements, Sept. 29-Oct. 2, Included Paving, City Planning and Traffic, Water Supply, Sewerage and Refuse Disposal

There are printed below abstracts of some of the papers, discussions and committee reports presented at the thirtieth annual convention of the American Society for Municipal Improvements which was held at Boston Sept. 29 to Oct. 2. —EDITOR.

Improving Pavement Subgrade

BY CLARENCE D. POLLOCK
Consulting Engineer, New York

WHEN the sub-soil consists of sand or other good granular and porous material a foundation 6 in. in depth of the standard 1:3:6 mixture of portland cement concrete is ample to place under pavements to carry modern traffic; but the question is, what is to be done when the soil consists of clay or other material which may become plastic and will not afford sufficient support for the foundation during at least part of the year? Placing a greater depth of concrete will help in spreading the load over a greater area of the soil, but it is expensive and if the soil is one which has a considerable volume increase with the increase of its water content this will not materially help matters, as the swelling of the soil will heave the heavier concrete about as readily as it will the lighter.

If instead of using a greater depth of concrete under such conditions a layer of the clay or plastic material is removed and replaced by a granular and porous material such as sand, gravel, or steam cinders, and the concrete foundation placed upon this material, it has been found that the sub-soil does not swell and lift the pavement. This granular layer not only provides drainage, but distributes the load over a larger area, similar to the ballast under railroad ties. It also decreases the friction on the under side of the concrete and thus helps in preventing the formation of cracks. It has been found, with clay against the under side of the concrete, that with even very small differences in temperature between it and the concrete there is a condensation of moisture on the under side of the concrete which in cold weather freezes and thus adds to the volume increase and consequent heaving of the pavement. With the porous layer between the foundation and the clay-soil there is no condensation on the bottom of the concrete and thus this trouble is avoided.

Studies are now being made to determine the proper thickness of the granular layer when it is required. The writer has obtained good results by the use of 5 in. and even 4 in., and understands that others report excellent results with some clays by using a thickness of 3 in. of granular material. In tests with some clays and a careful placing of the sand layer, a 2-in. depth has proved successful, but it would seem better to use a greater thickness than 2 in. because of the difficulty of obtaining sufficient uniformity of depth in actual construction.

Another advantage of a greater depth of the granular layer is that this layer will distribute the loads better on the sub-soil. Tests tend to show that it may be possible to decrease the thickness of concrete foundations below the standard 6 in. in many cases by the use of a porous layer, because of this feature of its distributing the load over a greater area of sub-soil. It is probable that it will be desirable to continue the use of concrete foundations 6 in. in depth in the larger and faster growing cities, because with the frequent openings due to the constant changes in the structures along the streets in such places, the bridging effect is valuable, if the backfill in trenches settles, as it is likely to do in many cases. But in other places where few openings may be looked for it is probable that a considerable saving may be made on the foundation so that a better and more durable pavement surface may be afforded. The writer has laid a large amount of granite block pavement on a 5-in. cement concrete foundation on sandy and gravel sub-soils without foundation failures as well as many miles of asphalt similarly without foundation troubles.

Black Base Construction

BY HARRY F. HARRIS
Engineer of Mercer County, New Jersey

TIME LOST by detouring traffic when a road is out of service during construction may materially be reduced by the use of the black-base type. After having provided properly for drainage and subfoundation the bituminous foundation is usually prepared and laid like an ordinary asphalt binder course, except that a mixture carrying about 25 per cent of sand makes a denser and more desirable mix when added to the binder stone in which the particles passing ¾- and 1-in. mesh sieves predominate.

As a rule the mixture is laid 6 in. thick. It is spread and rolled in two layers so that each layer does not exceed 3 in. after compaction. Upon this base a regular standard sheet asphalt top 1½ in. thick is applied in the usual manner.

* * *

Continuous City Planning

BY JACOB L. CRANE, JR.
City Planning Engineer, Chicago, Ill.

THE ADVOCATES of city planning constantly stress the point that with the completion of a plan the battle is only half won. Before we can expect a complete victory we must also carry through the other equally important phase of the operation, namely, selling the city plan to the public. It is my belief that in many smaller cities and towns the city plan is bound to be a failure or at best only half successful unless a third operation is carried on. That is the continuous survey and city planning study. I wish to emphasize the importance of such continuous city planning work wherever a community has had prepared and sold to it a city plan.

To begin with, a competent city plan is impossible of intelligent interpretation except by some one who helped to prepare it or who has given it exhaustive special study for the purpose of directing its application. For example, difficult points of interpretation arise in the application of every zoning ordinance, even in the smallest town.

In the second place, every competent city plan is based on an exhaustive survey of existing conditions: resources, present development, and tendencies of growth. But the conditions found in this civic survey do not remain the same. In spite of the control exerted by the city plan and the zoning plan, new tendencies will appear. For example, a large tract of land which had seemed particularly available for fairly dense residential development may be taken over for a golf course, and this immediately alters the requirements in that district for roads, parks, playgrounds and schools, and for all the public services.

Third, new inventions and their application create new facilities for public use which may entirely upset the soundness of a well organized plan. The automobile has done this in a number of instances; the airplane may do it again.

Finally, every city plan is laid out for only a definite limited period in the future, and as this period of fifteen, twenty-five or forty years approaches its close, the city plan must be revised within and extended beyond its original scope.

These are some of the reasons why we can not expect a city plan to be successful unless we add to the two-headed formula of "prepare a city plan," and "sell it to the public," a third, namely, "survey, and interpret and revise the city plan continuously."

In large cities a special city planning department should always be maintained. In the city and town under 50,000 the only feasible way to carry on continuous city planning is to have the consultant who was engaged on the preparation of the original plan also engaged, on the basis of an annual fee, to give adequate attention to the interpretation, adaptation, and development of the city plan. A draftsman might very well be installed to look after the collection of data and the preparation and revision of drawings. Furthermore, it is of very great importance that the city engineer and also the city manager, where there is one, understand the purpose and foundation of the city plan, and its application step by step.

* * *

Traffic and Street Design

BY ERNEST P. GOODRICH
Consulting Engineer, New York

ALL PROBLEMS as to traffic can be related to population or its distribution and activities.

Definite ratios have been found to exist between the areas which need to be set aside for residences, business, industry, parks and circulation. An area of 4,000 sq.ft. will house an average family of 5 persons. A 25-ft. front local store will care for 100 persons. Requirements for factory land are 2,000 sq.ft. per worker. In the average, eventually about 20 per cent of the population will probably be employed industrially. There are typical general conclusions which must be determined separately for each community.

Studies of many communities show one vehicle per family per day as the present-day city traffic which visits residential areas. Certain figures with reference to local commercial and to large industrial areas in one typical city are one vehicle per day per 5-ft. front and per 100 sq.ft. respectively. This traffic is largely automobile. In various cities traffic has been growing from the one-half to the seven-eighths power of the registration.

With certain assumptions as to population, commercial and industrial density it is an easy matter to determine the spacing and general arrangement of main thoroughfares. Thirty-foot roadways serving single-family houses on lots 50x100 ft. should feed into main thoroughfares spaced not to exceed 6,000 ft. apart. In two-family districts the spacing should be reduced to 4,000 ft. and for the average multi-family house district 2,500 ft. should be the maximum spacing between main thoroughfares. In industrial districts main thoroughfares should not be spaced to exceed 1,500 ft. and they should theoretically increase by units of 10 ft. for each 750 ft. in length as any street approaches the center of the community or other traffic destination point.

If attention is turned to transit facilities, including the street car and the motor bus, it is believed wise to space thoroughfares one-half as far apart as the figures above given, permitting cars and buses to operate on alternate thoroughfares. All other traffic has been ignored in establishing these figures and additional streets and street width must be provided to care for it.

* * *

Rubber Pavements

BY EDGAR S. DORR
Planning Engineer, Boston, Mass.

WITHIN the last two years a lively interest has developed in the subject of rubber pavements, as a means of utilizing the enormous accumulation of junk rubber in the form of worn automobile shoes. In London a rubber pavement has been in use since 1870 without renewal until a year ago. Another rubber pavement was laid thirteen years ago on Front St., Cuyahoga Falls, Ohio. In Racine, Wis., a practical rubber block has been perfected, while two concerns in Boston have developed very creditable rubber block.

The first cost of rubber pavement is estimated to be about three times that of asphalt or wood block. The rubber block pavement, however, is characterized by extremely long wear, noiselessness, smoothness, ability to absorb vibration, and non-slipperiness even in wet weather. As to wear, the Cuyahoga pavement showed ½ in. wear in eleven years and the St. Pancras pavement in London showed ⅞ in. surface wear in fifty-three years.

In the manufacture of rubber pavements both old stock and new rubber are used, molded into blocks or slabs and vulcanized under pressure. The amount of new rubber necessary varies from 15 to 38 per cent. The early rubber pavements were in the form of long slabs on a concrete base. When taken up the greatest wear was observed to be on the under side in contact with the concrete base. All of the later English forms of this pavement are blocks, rather than large slabs. A recent American rubber block is comparatively thin, with lugs on the under side to be forced into a plastic mortar bed to secure a bond with the base. Other forms of thin rubber block are attached, particularly to bridge flooring, by screws through holes in fins or lugs at the sides of the blocks. A positive mechanical bond still remains to be devised for economically attaching thin rubber block to a concrete base.

The Racine block, a short experimental section of which has been laid on the draw span of the Northern Ave. bridge in South Boston, is 12x6 in. and 1 in. thick with spiking flaps about ¼ in. thick, projecting at the bottom of the block and fitting into recesses formed in adjoining blocks. In addition to spiking, the blocks are cemented to the wooden deck of the bridge and to each other with a rubber and asphalt cement. Rubber pavement is peculiarly well adapted for draw spans, since it possesses enough elasticity to accommodate bending of the draw-span surface during opening and closing.

As to the present status of rubber pavement, as the writer sees it, it is practical for plank surface bridges and peculiarly desirable for draw spans both for economy and suppression of vibration.

* * *

Concrete Pavement Specifications

THE COMMITTEE on Specifications for Portland Cement Concrete Pavements (D. Q. McComb, Los Angeles, *chairman*) presented tentative recommendations, embodying suggestions made at numerous conferences during the convention. A few of the details from the new proposed specifications, which were submitted to the convention by E. E. Butterfield, Borough of Queens Laboratory, New York, a member of the committee, are given below:

Fine Aggregate—95 per cent of the fine aggregate, when dry, shall pass a ¼-in. screen; not more than 25 per cent shall pass a 50-mesh sieve, and not more than 5 per cent by weight shall pass a 100-mesh sieve. In no case shall fine aggregate be accepted containing more than 3 per cent, by dry weight, of clay, loam, or silt.

Coarse Aggregate—Coarse aggregate shall be uniformly graded within the following limits:

Passing 3-in. round opening, 100 per cent; Passing 2-in. round opening, not less than 82 nor more than 95 per cent; Passing ½-in. round opening, not less than 10 nor more than 25 per cent; Passing ¼-in. sieve, not more than 5 per cent.

Proportions—In no case shall the proportions be less than 1 part by volume of cement to 2 parts by volume of fine aggregate to 4 parts by volume of coarse aggregate.

Forms—Steel forms shall be used when practicable.

Reinforcement—Reinforcing materials shall consist of either fabric reinforcement, or steel bar mats made up of deformed steel bars.

The effective area of steel required shall be placed 2 in. below and parallel to the finished surface; 2 in. above and parallel to the subgrade, or both, as shown on the plans.

Fabric Reinforcement—Fabric reinforcement shall consist of sheets or strips manufactured for the purpose. The steel shall develop an ultimate tensile strength of not less than 65,000 lb. per square inch, and when subjected to a bending test cold shall bend 180 deg. around one diameter and straighten without fracture.

The ratio of effective area of cross-section of the transverse members, across the pavement, to the members lying parallel to the axis of the pavement shall be not more than 3 to 1.

Members shall be rigidly connected at right angles. Transverse members shall be spaced not more than 6 nor less than 4 in., and longitudinal members not more than 12 nor less than 4 in. No member shall have a right sectional area of less than 0.028 sq.in.

Fabric reinforcement shall be delivered in flat sheets of length 4 in. less than the width of pavement laid, and shall be clean, free from excessive rust, mud, clay, paint, oil, grease or any other coating that will interfere with proper bond with the concrete. Adjacent sheets shall be lapped not less than 6 in.

Bar Mat—Bar mats shall be made up in sections of convenient width and of length 4 in. less than the width of the pavement laid and shall be made up of round or deformed bars manufactured from either open-hearth or Bessemer steel and shall be rolled from standard new billets. Bars shall have an ultimate tensile strength of not less than 55,000 lb. per square inch and when subjected to a bending test cold shall bend 180 deg. around two diameters and straighten without fracture, shall be free from scale, oil, or excessive rust or other deleterious material and shall be straight and true to dimensions called for on the plans.

No member shall have an effective cross-sectional area of less than 0.11 in. Members shall be spaced not more than 18 in. apart in either direction and shall be fastened together at each intersection by means of a spring steel clip or other device which will not loosen nor permit the bar to rotate. Accuracy of bending is essential. Effective area of steel shall be that lying in the plane or planes previously described. Mats shall be rigidly supported on approved chairs, bends or stirrups. Bars shall be lapped not less than 30 diameters.

In designing reinforcing the ratio of effective area of steel in the transverse section to the effective area in the longitudinal section should be as near the ratio of the width of pavement to the length of slab as practicable.

Transverse Joints—Transverse joints shall be formed perpendicular to the pavement surface and to the axis of the pavement, at the end of any run, or where the laying of the concrete has been stopped for 30 min. or longer, and at such points as may be indicated on the plans, provided that no section shall be less than 15 ft. in length. The joints shall not be less than ¼ nor more than ½ in. in width.

Longitudinal Joints—Longitudinal joints shall be formed parallel to the axis and perpendicular to the surface of the pavement. Such joint shall consist of a concealed metal strip not less than No. 18 gage, deformed in such a manner as to provide a tongue and groove in the concrete adjacent thereto and rigidly held in place. . . . Strips shall not be less than 10 ft. in length and if longer strips are used the length shall be some multiple of 5 ft.

* * *

Discussion on the Utilization of Old Granite Block

BY R. A. MACGREGOR
Bureau of Highways, Borough of Manhattan, N. Y.

A LARGE percentage of old style granite blocks, 9 to 12 in. long and 6 to 7 in. deep, may be broken in two, making blocks 5 in. deep, the fresh surfaces becoming heads. Dressing is important if bituminous filler is to be used on the ½-in. joints now generally specified. The sand or sand-cement cushion should be kept as shallow as ½ in. under the deepest blocks and blocks must be rammed to a solid bearing.

Recut blocks from a given area may pave only 50 to 60 per cent of the original area unless they are in good condition. Where the old blocks are good and the joints are specified as ¾ in. the old blocks will provide recut blocks for an area equal to or a little greater than the original area. The saving in cost may amount to as much as $3 per square yard.

BY NATHAN L. SMITH
Associate Civil Engineer, Paving Commission, Baltimore

THE recommended procedure for utilizing old granite blocks is at follows:

(1) Redress the largest and best shaped for liners along railway tracks.

(2) Recut by "nick and nap" method all blocks in satisfactory condition.

(3) Repave in alleys without redressing all blocks unfit for cutting but too good to discard.

(4) Use all spalls and rejected blocks for formation of underdrains and header runoffs or crush for coarse aggregate for concrete base.

Centrifugal Concrete Pipe in England

London Correspondence

THE PRINCIPAL British plant for manufacturing concrete pipe by the centrifugal process under the Hume patents, the Stanton Ironworks Co., makes unreinforced pipes 8 ft. long with a socket at one end of the usual formation and ordinary T-branch pipes and 45-deg.-angle branch pipes. The following mixes are used: For class A pipe to deal with working pressures of 10 lb. per square inch, the mixture is three parts of graded granite with one part cement and sufficient suitable sand (in no case exceeding one part) to insure an absolute filling of the voids. For class B pipe, dealing with working pressures up to 25 lb. per square inch, two parts of graded granite, one of cement and sand as before. For higher pressure pipe the proportions are sand two parts, cement one part. The cement used is guaranteed to exceed a tensile strength of 800 lb. in seven days.

BURSTING TESTS OF CENTRIFUGAL CONCRETE PIPE

Nominal Diameter In.	Thickness In.	Mixture	Percentage Reinforcement	Age Days	Bursting Pressure Lb. per Sq.In.	Calculated Tension Lb. per Sq.In.
4	0.81	4:7:9	Nil	32	125	409
9	1.00	1:1:3	Nil	28	80	365
9	1.06	1:1:3	Nil	28	85	412
9	1.19	1:1:3	Nil	90	94	403
9	1.09	1:1:3	Nil	90	90	425
9	1.16	1:1:3	Nil	90	100	440
9	1.12	1:2	Nil	28	94	429
9	1.12	1:2	Nil	28	100	456
9	1.20	1:2	Nil	90	94	400
9	1.11	1:2	Nil	90	102	465
9	1.06	1:2	Nil	90	110	535
4	1.01	1:1½	0.87	43	385	896
16	2.58	1:1½	0.34	33	163	580
24	1.87	1:1½	5.00	48	146	610
6	0.94	3:4:7	0.43	30	125	454
6	0.94	3:4:7	0.45	37	125	452
12	1.01	1:2:2	0.64	35	62	382
15	1.31	1:2	0.34	36	100	408
9	1.00	1:2	2.16	35	150	568

The smaller pipes are rotated six at a time; intermediate sizes four at a time; while the larger sizes, up to 72 in. diameter, are rotated two and one at a time.

The results of some bursting tests are given above. It is found that when excess internal pressure is applied the pipes expand and allow the excess to percolate through the wall of the pipe. When the excess pressure is removed the pipe closes up and becomes as impermeable to ordinary pressure as when it was first constructed.

Swiss Railway Electrification

Continued progress on the electrification of the principal railway lines in Switzerland is demonstrated by the recent opening to electric traction of the line from Olten to Basel completing the electrification of one line for the entire distance across the country of 197½ miles from Chiasso on the Italian frontier to Basel on the German-French frontier. The completion of this line brings the total mileage of electrified railways in Switzerland up to 315 miles. The electrification work was started to make the Swiss Railways independent of the coal supplying countries, largely the outgrowth of war conditions when fuel was expensive and the supply uncertain. Under present conditions the cost of operating with coal is less than that of operating by electricity, the average cost per kilometer with steam traction in 1923 being 97 centimes against a cost of 128 centimes per kilometer for electric traction.

From Job and Office

Hints That Cut Cost and Time For the Contractor and the Engineer

The Pitometer as a Part of a General Water-Works Survey

By V. Bernard Siems
Water Engineer, Baltimore, Md.

IN BALTIMORE, the pitometer survey has gradually lost its significance as a leak survey only and has become part of a collective survey of all phases of the condition and performance of the water distribution system that can be based upon field observations. With the pitometer survey there are conducted surveys of valves, private pipes, fire lines and meters, domestic meters, record measurements, pressure, flow test, fire protection, future requirements, electrolysis, and most recently of all, the collection of samples to determine the quality of the water as delivered to the consumer. In the latter we have the co-operation of the Health Department which collects samples for bacterial examination so our laboratory is able to devote its time to the important work of making quantitative chemical analyses.

When work in a pitometer district is begun and the various gaging-point taps have been made the Health Department sample collector is notified. Proper precautions are taken to insure true samples of the water as delivered in the main. Although water samples are ordinarily taken from the pitometer tap, other places, such as house taps, fire hydrants, main blows, etc., are chosen when indicated by certain physical conditions of the gridiron, such as dead-end mains from which service connections are supplied, flanked mains as caused by closed valves at a division of service, etc., which are known or observed in the district being surveyed.

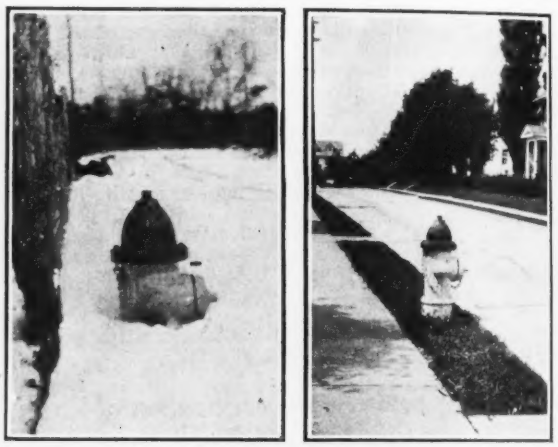
The Health Department and our own laboratory results are recorded together and any point where abnormal water has been found is located upon a map of the water distribution system. To prevent error, abnormal results are checked before being recorded. This information is then reviewed and if necessary studies made for the purpose of correcting the design of the system by additional gridironing, or, if such is impossible, by taking the last service connection off of the cap in the case of a dead-end water main, or by installing a blow-off from the cap to be used in flushing the main periodically. This systematic investigation of the quality of the water supply at the end point in its distribution is, to the best of my knowledge, unusual in water-works practice, but is warranted by the resulting ability of the department to anticipate complaints of distasteful or turbid water and have at hand pertinent information or plans for improvement covering each case.

This is only one of the results we are obtaining in Baltimore from the scheme of conducting the regular leak survey as a collective survey of the water distribution system, the success of which warrants a recommendation of the method to other water-works engineers.

Green Cap and Gray Barrel Color Scheme for Fire Hydrants

By Robert Morse
Chief Engineer Washington Suburban Sanitary District, Hyattsville, Md.

THE SUBJECT of painting fire hydrants has aroused considerable discussion recently in water-works circles. General recognition is being given to the advantages of a high degree of visibility and to color schemes which will effect it. Not so much thought seems to be given to pleasing appearance. Yellow, red, white, and gray, sometimes singly but often in combination, seem to be the favorite colors for producing greater distinctiveness than the conventional black or



HYDRANT COLOR AGAINST SNOW (LEFT) AND AGAINST BACKGROUND OF GRASS AND CONCRETE (RIGHT)

green. Where two colors are used, the lighter frequently appears on the cap. In the writer's opinion this is a mistake. It does not catch the eye as readily as a combination of dark color above and light on standpipe below; nor is the appearance as good. With deep snow on the ground, the light cap gives a poor contrast.

In the Washington Suburban Sanitary District thorough consideration was given to the selection of two colors whose combination would cause the hydrant to stand out against grass, concrete or snow and at the same time be pleasing to the eye. One color could not do this as well as two. Dark green and light gray were finally decided upon. The standpipe, including nozzle caps, and the upper section of the frost case are coated with a mixture of two parts of gray and one part of white paint. Green paint is applied to the cap. As the hydrants come from the factory with this color combination, it is necessary to use only one coat after they are installed.

The field coat of paint is applied by the regular hydrant and valve inspection gang. This arrangement has been found economical. All hydrants are inspected

at regular intervals and are repainted when their appearance warrants such action.

The effectiveness of the color combination when snow is on the ground is evident from the view taken on March 21, after the hydrants had been painted for about a year. Another view shows the appearance against a grass and cement background. One of the most important advantages of this color scheme is the ease with which the hydrant may be found at night. Firemen have commented frequently on this feature.

Sub-Basements of Newspaper Plant Built by Progressive Underpinning

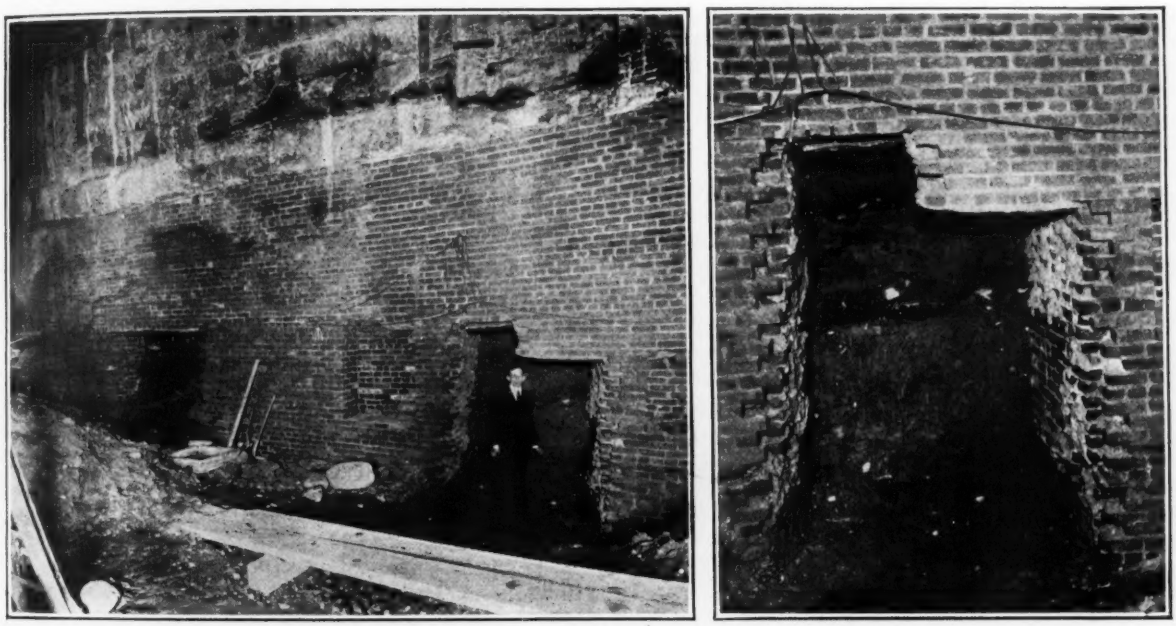
By Edwin S. Parker
Structural Engineer, Boston

Some years ago the Boston *Post*, unable to expand on any side and unwilling to move to entirely new quarters, found itself facing the choice of either building up or digging down. As building up is almost certain to disturb a going plant, the other method was chosen—constructing sub-basements under the building by underpinning. The process was outlined and executed by a veteran builder of Boston, John F. Griffin. The old basement was about 10 ft. deep, and the new walls in the first excavation, under the Washington St. building, were carried down to about 60 ft. below the street, giving a basement, sub-basement, and sub-sub-basement, in each of which presses were set.

A hole was dug under a section of the wall 6x6 ft. or thereabouts, leaving the bank behind true and at the right depth in from the face for the proposed thickness of wall, and the bottom level. A true layer of mortar was then laid on this bottom and brick masonry was laid up to the wall above, filling the hole. Any unevenness in the bank behind was backfilled. The last bricks at the top were split wedge-shaped and driven in, in plenty of mortar. The sides of the new section of wall were pocketed to bond with the next "leg" or block. Then another section of wall was constructed, far enough from the first to allow the mortar to set before an adjacent leg was dug, and so around the building, though the second course might be started in some places before the first course was completed all around. In general, the process was to dig a hole under the wall and then brick it up, using common sense as to where to locate each new unit and how large to make it. The successive blocks should be staggered to leave a wall of brick blocks with broken joints.

The walls of the Washington St. excavation were made 3 ft. thick, with 12-in. buttresses at intervals. The ground was blue clay with seams of gravel and boulders. These boulders were kept in the excavation and finally buried under the floor, which saved hoisting them out and gave good under-floor drainage to the sump.

Water shows on the walls at grade —8, which is 9 ft. above the lowest floor. Fighting water with brick proved to be very costly, and the subsequent excavations have not gone below the sub-basement level, grade 2.72. The quantity of water is very small and is easily handled by a sump and automatic pump.



PROGRESSIVE UNDERPINNING OF "POST" BUILDING
At left, view showing arrangement of legs or pockets in a sub-basement course; at right, detail view of a leg.

The work under the School St. section of the plant came just at the time of the building strike in 1921, and the *Post*, being a union shop, kept the work going with Mr. Griffin's foreman. In this and subsequent work the writer was engineer in charge. The method of procedure was the same as before and the accompanying pictures give an idea of how the walls looked.

We struck blue clay entirely, and one section of the bank was hard to hold but it produced only ¼ in. settlement. Water showed a few feet below the sub-basement floor, and was carried to a sump as before. With water showing at this grade here and elsewhere on this property, one can only conjecture what happens to piles cut at grade 5 as they are in Boston.

An attempt was made to design these walls for bending resistance, though they had to be about 4 ft. thick

to carry the walls of the adjacent property. Bending acts on the vertical span between floors, where the walls are held. Considering it as simply supported at the ends, the wall was found to have a bending stress well within the allowable limit. It has additional safety because the spans of wall are actually continuous beams.

In the latest excavation, begun in April of this year and just completed, we wanted to keep the thickness of walls down to a minimum, as there were no adjacent walls to carry. I found that the foreman wanted to use a 1:1 cement-sand mortar, which seems easier to work than leaner mortar without lime, and I figured the walls on this basis, but allowed for the cohesion of the bank before slipping. These walls we made 30 in. thick.

Walls built thus against a bank set up tremendously hard, and really form an integral mass. The bank apparently keeps it just moist enough for perfect setting.

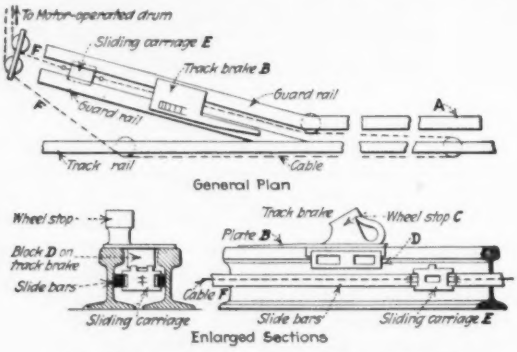
The work here was complicated by a heavy concentration on an inside corner, but by shoring and careful placing of the legs we had no trouble. This excavation, almost adjacent to the others, was mostly in fine beach sand. A good deal of back-fill was necessary, but the walls here are as true as though laid from the bottom up.

In the previous work the settlement was ¼ in. in 50 ft., due probably to shrinkage in the mortar, but here there was initial settlement of ⅛ in. and none later.

This method of underpinning has the advantage of being easy to execute. It requires no great shoring and involves only a small part of the wall at one time. Hence no large accident is possible.

Track Brake Checks Cars in Yards

AN AUTOMATIC track brake or shoe brake for checking the speed of cars in gravity switching yards is being tried by the Northern Ry., France, in its yard at Lille. In ordinary practice, yard men place shoes on the rails so that the wheels ride up on the



BRAKE DEVICE FOR GRAVITY YARDS

shoes, which then slide along the rail. The object of the new appliance, shown in the accompanying drawing, is to avoid this dangerous hand work.

A guard rail, *A*, is placed parallel with one of the running rails on the body track for about 60 ft., forming a groove; two guard rails then extend the groove at an angle so as to pass away from the track. A feather-edge plate, *B*, riding on the two rails has a stop, *C*, for the wheel and a block, *D*, on the lower side sliding in the groove between the two rail heads.

From Job and Office

Hints that Cut Cost and Time

Bars riveted to the rail webs form guides for a sliding block, *E*, attached to an endless cable, *F*, operated by a motor-driven drum. Lugs on top of this block engage the lower part of the sliding shoe. The switchman in the tower notes the speed of the car and by a push button causes the motor-driven rope and block to push the brake shoe along the groove. Current is then reversed automatically and the block is drawn back, leaving the shoe in place. The car wheel rides up on the plate against the stop in the usual way, causing the shoe to slide along the rail. But at the point where the groove diverges from the running rail the shoe is guided away from the wheel, leaving the car free to proceed at reduced speed. The device is then ready for a second operation.

To give different lengths of travel of the shoe, according to the speeds of different cars, a number of electric contacts are placed along the groove, any desired one of which can be energized by the switchman, so that current will be cut off automatically when the shoe reaches it. In this way the travel of the shoe after the car wheel engages it may be from 12 to 40 feet. Improvements now being made, however, will simplify the electrical apparatus materially.

Machine for Compacting Bridge Cables

BY CHARLES CARSWELL
Delaware River Bridge Joint Commission, Philadelphia

A NEW TYPE of compacting machine has been developed for compacting to the smallest practicable diameter the large cables of the Delaware River Bridge. On suspension bridges already constructed compacting has been accomplished by a clamp-like mechanism consisting of two semi-circular castings hinged at one side and forced together by a hydraulic jack at the opposite side. This type of machine is inadequate for the 30-in. cables which are used in the new bridge.

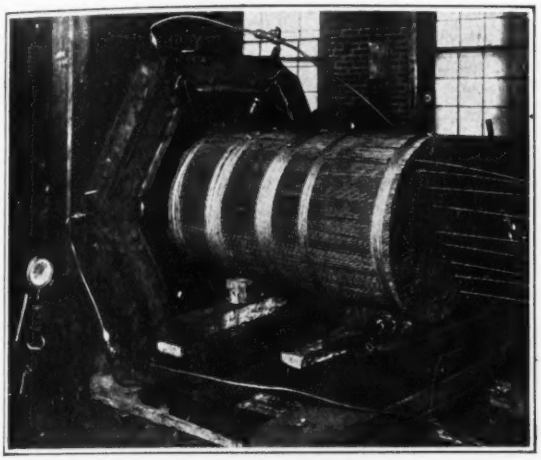
The compacting machine consists of a hexagonal steel girdle made of six pairs of channels arranged to take the reaction of six hydraulic jacks. Castings machined to circular radius are attached to the jacks, and as pressure is applied they force the cable wires together into true circular shape. The hexagonal shape is adopted not only to secure pressure at a sufficient number of points but also because the cable strands are laid up in hexagonal form before the cable is compressed to the circular shape, and the pressure is thus applied at the points of this original hexagon. Pressure is applied simultaneously to all the jacks, producing uniform and thorough compacting. The pressure at the pump reaches 6,000 lb. per square inch, and the total force brought on the cable is about 30 tons. The diameter when thus compacted will be 29⅛ in.

Since the Delaware River bridge cables are of such unprecedented size, a model section was prepared to determine, in advance of the completion of the cables, exactly what diameter the compacted cables will have. The diameter must be known accurately in order that

From Job and Office

For Contractor and Engineer

the cable band castings can be machined to correct radius so that there will be no danger of slipping. The model section is 5 ft. long. Wire for it was taken from the regular wire being produced for the cables, and was cut to length and laid up in 61 strands of 306 wires each in the same manner that the wires of the cables will be placed. Splices were made in sufficient wires to secure in the model section the same



TEST LENGTH OF CABLE IN COMPACTING MACHINE

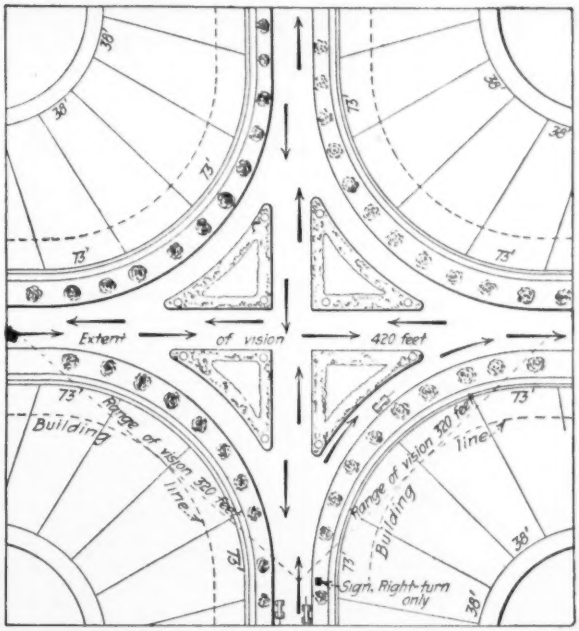
proportion of splices that will occur in the completed cables. Compacting of this model section by the new machine reduced it to the diameter of 29⅛ in.

Street Intersection with Curved Layout

A METHOD of planning intersections to facilitate the flow of traffic and also to secure a larger amount of frontage than ordinary subdivision methods afford has been employed at Shorewood, a suburb of Milwaukee, Wis., and is shown by the drawing.

The principle is that a wide curve at street corners makes it possible for traffic to follow along smooth lines and also to have a long range of vision when approaching the intersection, while it also enables lots to be placed so that they front upon the long curve instead of fronting on one street and having a side lot line on another street. With the arrangement shown, a driver approaching an intersection can see 400 ft. down the cross street, while he is still 400 ft. from the intersection. If he is going to the right, he has a curved roadway to follow instead of the ordinary sharp curb corner.

Each intersection provides about 300 ft. more frontage than in the ordinary right-angled block. This is due to arranging the lots with frontage around the long curve. In addition, the improved outlook is considered to make these lots more desirable than ordinary corner lots so that they would bring a better class of improvements, which in the tax yield would help to carry the extra cost of the pavement in the intersection. A further advantage claimed is that all lots front on the pavement and none are compelled to pay for improvements both on the front and on the side.



CURVED STREET INTERSECTION AT SHOREWOOD, WIS.

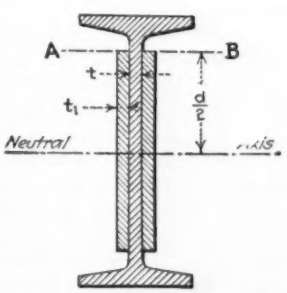
If the traffic should not require such long curves, the area of the paved intersection could be greatly reduced, the property lines remaining about as shown, but the curb lines being practically the same as in ordinary practice, leaving a wide parkway strip between the curb and sidewalk.

This form of intersection and lot layout was devised by H. A. Schmitt, village engineer of Shorewood, who has applied for a patent on the design.

Reinforcing the Web of Rolled Beams To Carry Excessive Shear

BY ABRAHAM FRANK
Structural Engineer, New York City

THE EXTENSIVE use of girder beams with thin web, having high resistance to bending but comparatively weak in shear, and setbacks in upper stories of buildings, which often give heavy concentrations just a few feet from the end of the span and therefore excessive shear for a short length of the girder, have made web reinforcement for rolled beams an important matter. Such web reinforcement usually consists of flat plates riveted to the sides of the web. The extent to which these plates increase the shearing capacity of the beam is often exaggerated; designers are apt to proportion them on the assumption that if the cross-sectional area of the plates can resist the excess end shear of 10,000 lb. per square inch, the beam will be safe. This is an obvious fallacy, yet many responsible designers commit this blunder.



BEAM WITH WEB REINFORCING PLATES

As one instance, two $\frac{3}{8}$x9$\frac{1}{2}$-in. plates were used to make a 12$\frac{1}{2}$ G 61 safe against a shear of 36.1 tons. The beam is listed in the handbooks as good for a shear of 24.55 tons, and the plates were considered good for an additional 35.6 tons. The $\frac{3}{8}$-in. plates were used only because they were of the minimum thickness permitted where $\frac{3}{4}$-in. rivets were to be used.

In order to fit tightly against the web without riding the fillets of the beam, the shear plates must be made of a depth much less than the clear distance between flanges. The result is that above and below the plates we have portions of the web with only the original thickness resisting shearing stresses; and no matter how much we make the *total* area of the section, in these thin portions the intensity of the horizontal and vertical shearing stresses may exceed the safe value for the steel.

If we start with the common premise that the beam continues to take all the bending, we are forced to the conclusion that the longitudinal stresses above plane *AB* (see sketch) are exactly the same as they were before the shear plates were added, and that therefore the horizontal shear on *AB* is the same with or without the plates. In such a case the plates would aid the web only by restraining it against the diagonal buckling resulting from shear. If the plates are to resist the vertical and horizontal shearing stresses, they can do so only to the extent to which they take bending and reduce the direct stresses of tension and compression in the beam.

It thus becomes of primary importance to make the shear plates as nearly as possible an integral part of the beam. When this is done, then the usual formula for finding the intensity of shear at any point in a beam,

$$v = \frac{VM_s}{tI_c}$$

will apply to any point in the plane *AB*. Here V is the total shear on the vertical section through that point, M_s the static moment about the neutral axis of the portion of the section above *AB*, t the thickness of the web at *AB*, and I_c the moment of inertia of the composite section. In this equation we note the important fact that the shearing capacity of the beam is increased (nearly) proportionately to the increase in the moment of inertia of the section and not proportionally to the increase in the area of the section.

Knowing that the maximum intensity of shear occurs in *AB*, we may allow at this point the full value of 12,000 lb. per sq.in. for steel in shear. Then if we designate by I the moment of inertia of the beam alone, and by t_1 and d the thickness and the depth respectively of each shear plate, and make our units, pounds and inches, we get as the total safe shear on the reinforced section,

$$V = \frac{12{,}000t\ (I + \frac{1}{8}\ t_1d^3)}{M_s}$$

or knowing the maximum vertical shear which is to come upon the beam we can find the thickness of the shear plates by

$$t_1 = \frac{d^3}{6}\left(\frac{M_sV}{12{,}000t} - 1\right) \qquad (1)$$

To get rid of the troublesome quantity M_s we note that the total safe shear on the unreinforced beam is

$$V^1 = \frac{12{,}000t\ I}{M_s^1} \qquad (2)$$

where M_s^1 is the static moment about the neutral axis of the half section of the beam, and the unit stress of 12,000 lb. per sq.in. is allowed at the neutral axis. It can be easily shown that

$$M_s = M_s^1 - \frac{Wd^3}{8} = \frac{12{,}000t\ I}{V^1} - \frac{td^3}{8}$$

We can therefore make (1) read,

$$t_1 = \frac{6I(V - V^1)}{d^3V^1} - \frac{V}{16{,}000d} \qquad (3)$$

which formula includes only quantities that can be taken directly from handbooks.

It is true that in the handbooks of the steel manufacturers the safe shearing values V^1 of the beams are usually listed for an average stress of 10,000 lb. per sq.in. on the area of the web, as this is considered to be close enough to the exact value given by eq. (2). We may continue to make this approximation. Where the handbooks give the safe shear as determined by diagonal buckling, we must find the value of V^1 as above for an average stress on the web of 10,000 lb. per sq.in.; for the shear plates are incidentally reinforcment against diagonal buckling.

Eq. (3) shows us that in the case mentioned above, to make the 12$\frac{1}{2}$ G 61 safe against an end shear of 36.1 tons a thickness would be required for each plate of

$$t = \frac{(6)\,(479.9)\,(72{,}200 - 49{,}700)}{9.5)^3(49{,}700)} - \frac{(72{,}200)}{(16{,}000)\,(9.1)} = 1.04 \text{ in.}$$

rather than something less than $\frac{3}{8}$ in.

Motorists Informed of New Road Jobs

IN ORDER to inform the public, particularly that part traveling over the highways in motor cars, of its construction work the California Highway Commission has adopted the policy of erecting a sign at each end of important road contracts, noting mileage and cost of the work under way, what bond issue the funds came from and the names of contractor and resident engineer. The seal or insignia of the highway commission is also given a conspicuous place, thus associating it in the mind of the traveling public with highway improvements. A typical sign is shown in the accompanying illustration.

From Job and Office

Hints that Cut Cost and Time

From Job and Office

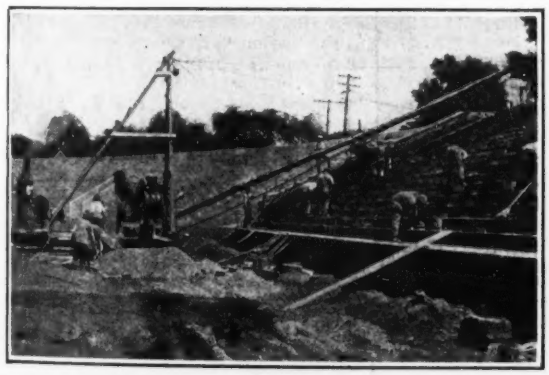
For Contractor and Engineer

Novel and Inexpensive Method Devised for Placing Concrete in Stadium

ONE OF THE difficulties encountered in the construction of the stadium for the Scott High School at Toledo, Ohio, was distribution of a comparatively small yardage of concrete over a large area, the thickness of the stadium slab being only 4 in. including the finish. Use of runways for the operation of buggies or wheelbarrows was considered impracticable due to the height of the stadium at the rear and also the difficulty of working around the multiplicity of I-beam seat supports. Because of the small amount of concrete involved, use of tower and gravity chuting equipment for concrete distribution was also deemed inadvisable.

The contractors, J. H. Berkebile & Sons, therefore conceived the idea of erecting an A-frame mounted on traveler wheels and rails to which was attached a 7-in. I-beam 55 ft. long covering the full depth of the stands. A concrete mixer and a small hoisting engine were mounted on the platform of the A-frame. A traveler wheel ran along the I-beam carrying a specially-designed concrete bucket. With this outfit little difficulty was experienced in distributing the concrete to any desired place without disturbing seat supports or without the use of runways. When the bucket was empty it automatically returned to the mixer, was filled and hoisted.

The treads of the stadium are monolithic and were



CONCRETE DISTRIBUTING PLANT ON TOLEDO STADIUM

finished the same day concrete was poured. The following day riser forms were removed and the risers rubbed to a smooth finish.

With the use of this distributing plant the contractor practically completed a concrete stadium costing about $100,000 in nine weeks from the time excavation began.

Job and Office Notes

A Method **Employed in Mixing** the aggregate for a concrete retaining wall located in the Midwest, is worth noting as an example of practice to be avoided, writes a correspondent. Sand and gravel delivered separately in slat-bottom wagons were dumped in one stockpile. With a slip scraper and team the materials, in ever-varying proportions, were moved to a platform near the toe of the stockpile and then shoveled into a charging hopper below, this hopper in turn delivering the aggregate to the mixer. The only mixing or grading of the aggregate was that due to the horses' hoofs, the wagon wheels and the scraper, so that the proportions of fine and coarse aggregate varied greatly and irregularly. Part of this concrete was placed under water by a tremie, but the tremie occupied one position for each section of the wall, the concrete being assumed to flow over the entire area. These methods were employed on a day-labor job left in charge of a foreman.

Fordson Tractor Makes Light Roller

ON any truck-haul paving job, the finished subgrade ahead of the mixer is cut up by the wheels of loaded vehicles. A Fordson tractor with cleats removed and rear wheels filled with concrete makes an ideal roller for smoothing out these irregularities. Its usefulness as a tractor is only slightly impaired.

A Unique Hydrant Installation to decrease fire hazard in lumber yards was made this spring in the lumber storage yard of the Northwest Pacific R.R. in San Francisco. Placed at intervals of 150 ft. throughout the lumber storage yard, the hydrants are direct-connected to an underground main which receives its water supply from two independent sources. A 50-ft. hose is mounted on a reel placed in a box set on a post directly back of each hydrant. When a fire alarm is given, the box is swung open on the hinge thus allowing the reel to swing free of any obstruction, then the hose is quickly attached to the hydrant and by use of a double reel is speedily unwound. When the box is closed, the hose is protected from the elements and also from the view of trespassers.—*American Lumberman.*

Low-Temperature Impact Tests of steels carried out last year at the National Physical Laboratory of Great Britain are briefly noted in the annual report of the laboratory for 1923, just published. Tests were made at temperatures of 63 deg., —37 deg., and —112 deg. F. With a notched Charpy specimen (5x5x30 mm.), plain carbon steels developed brittleness more than did hardened and tempered nickel-chromium steel and hardened high-nickel case-hardening steel. Mild steel showed a large reduction in the notched bar impact strength when the temperature was reduced to —37 deg., while the same effect did not appear in impact tests on unnotched pieces.

Glasgow, Scotland, Will Use Its Refuse incinerator, now under construction, to generate power. The plant will have a daily capacity of 480 long tons, which can be increased to 1,000 tons. All the refuse of the city, except that containing metal, will be put through the furnaces. The steam produced will be used for the generation of electricity, which will be distributed by the city. The contract for the plant was awarded to Heenan & Froude of Worcester, England.

Letters to the Editor

This department aims to be a forum for the discussion of the views of engineers and contractors. The range of interest should be as wide as possible. Contributors are, therefore, asked to make their letters short.

Grading Curves for Concrete Aggregate

Sir—I have read with interest the article, "Analysis of Grading Curve for Concrete Aggregates," by L. I. Hewes (*Engineering News-Record*, Aug. 7, p. 222) in which he points out certain mathematical relations between the surface area, fineness modulus, density, etc., of aggregates.

Mr. Hewes states that the "fineness modulus has been variously defined and calculated." While it is true that we have described two or three different methods of *calculating* the fineness modulus, we have constantly adhered to one definition, which gives a clear conception of its relation to the grading: The fineness modulus is the sum of the percentages in the sieve analysis divided by 100, when the sieve analysis is expressed as percentages coarser than sieves (ranging from the 100-mesh sieve as finest and without any upper limit) in the Tyler standard screen scale. See Bulletin 1, Structural Materials Research Laboratory.

A number of errors have been found in Mr. Hewes' mathematics. From our conception of the fineness modulus as a function of the area under the sieve analysis curve (which is only a graphical method of representing this function and of course does not represent a new definition) he sets up a definite integral which includes the term $\log_e 2$; this term should be $\log_{10} e$.

In deriving the constant for evaluating this definite integral by measuring the area found by plotting the curve for $\frac{y}{x}$ against x to a certain scale, the expression

$$K = \tfrac{1}{2}\,\frac{\log_{10}2}{\log_{10}e} = 7.2134$$

should read

$$K = \tfrac{1}{2}\,\frac{\log_{10}e}{\log_{10}2} = 0.72134$$

It is interesting to note that our mathematical expression for the fineness modulus of a particle of a *given size* ($m = 7.94 + 3.32 \log d$ where d = diameter of particle and the logarithm is to the base 10) can readily be derived from Mr. Hewes' equation (2), when this equation is corrected as pointed out above. We have assumed that the diameter of a particle of a given size group is constant and that the lower limit of *screen* size for *positive* values of fineness modulus is 0.0041 in. (the anti-logarithm of the average logarithm of clear openings for the 200 and 100-mesh sieves).

Mr. Hewes' equation (3) purports to show the rate of change of fineness modulus with respect to the maximum or minimum sieve considered for a given aggregate, but it seems to indicate an erroneous conception of the fineness modulus. The summation of the percentages up to any size less than the maximum or down to any size greater than the minimum cannot be considered as fineness modulus, since this includes only a portion of the area under the sieve analysis curve.

We have previously pointed out that the fineness modulus "may be considered as an abstract number; it is in fact a summation of volumes of material." It follows also that if the fineness modulus is calculated from the diameter of the particle it is necessarily a function of the *volume* of the particle. While the simple method of calculation which we use (i.e. summation of the percentages in the sieve analysis) depends on a definite set of sieves, it is obvious that by use of graphical methods or by application of our logarithmic equation given above, any set of sieves may be used, so long as their separation sizes are known. This, of course, is only another way of saying that an area may be calculated from many different sets of ordinates. It is difficult to see wherein Mr. Hewes' observations have added anything to our knowledge of this factor as a method of dealing with concrete aggregates.

Mr. Hewes' discussion of density is interesting from a purely theoretical point of view. It neglects the important fact that aggregate particles *do not* arrange themselves in a manner even approximating that required for maximum possible density such as might be obtained by placing properly-sized spherical particles by hand in the most compact manner. Tests carried out in this laboratory indicate that the size of particle which will go into the openings between particles of a given size, when measured loose, are nearer ½ the diameter of the larger particle than 0.41 and 0.22 required for maximum possible density. In his equation for solidity ratio, the radical should extend over 2 only, instead of over $2(n\text{-}1)$.

Mr. Hewes' analysis of the surface area gives a conception of this function which so far as we are aware has not heretofore been pointed out, namely, that the surface area is proportional to the area fixed by a curve obtained by plotting percentages coarser than different sizes against the reciprocal of the size. This statement enables us to more clearly visualize the relation between the surface area of material and its grading.

The writer acknowledges his indebtedness to Stanton Walker, associate engineer at this laboratory, and Walter Bartky, instructor in mathematics at Lewis Institute, for checking the mathematics of this discussion.

D. A. ABRAMS,
Professor in Charge, Structural Materials Research Laboratory, Lewis Institute.
Chicago, Ill.
Aug. 23, 1924.

[Mr. Abrams' letter was referred to Mr. Hewes, whose reply is given below.—EDITOR.]

Sir—Referring to Mr. Abrams' letter of Aug. 23, it is true that a number of small errors appear in the article by me in your Aug. 7 issue, some of which Mr. Abrams points out. Taking these up in order:

$\log_e e$ should replace $\log_e 2$ throughout the article, and the expression $K = \frac{1}{2}\,\frac{\log_{10}e}{\log_{10}2} = .72134$ is correct and is the numerical value that was used in calculating Table II. The equation for the solidity ratio of the spherical grading contains the typographical error indicated by Mr. Abrams but the computations were made from the correct formula. There are some additional errors in printing not mentioned by Mr. Abrams:

Page 224, line 28, d ($\log 2x$) should read: $d(\log_e x)$.
Page 225, line 15, the second "of" should read "or."
Page 226, 11th line from the bottom: k_1 should read K_1.
Ninth line from bottom: $k_1 \frac{dy}{dx}$ should read $K_1 \frac{y}{x}$.

The fraction of the aggregate for which the term "fineness modulus" shall have significance appears undetermined since Mr. Abrams recognizes a formula for the fineness modulus of a *particle of a given size* and offers a formula for calculating such a quantity, yet he states that:

> "The summation of the percentages up to any size less than the maximum or down to any size greater than the minimum cannot be considered as fineness modulus, since this includes only a portion of the area under the sieve analysis curve."

Mr. Abrams says with reference to the discussion of density from a theoretical point of view:

> "It neglects the important fact that aggregate particles *do not* arrange themselves in a manner even approximating that required for maximum possible density such as might be obtained by placing properly-sized spherical particles by hand in the most compact manner."

The discussion of theoretical density was very carefully presented to avoid any erroneous conclusions with reference to practice, and it was stated:

> "In practice the solidity ratio indicated by the theoretical spherical pack for the various fractions or for the entire sample could not even be approximated, yet the curve serves as a comparison standard of considerable value."

It is my belief that the curve does so serve and that in opening up the question of omission of certain indeterminate sizes from the coarse aggregate mix there may result useful discussion.

L. I. HEWES,
Deputy Chief Engineer, U. S. Bureau of Public Roads.
San Francisco, Calif.,
Sept. 29, 1924.

News of the Week

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Rensselaer Institute Holds Centenary Celebration

Distinguished Engineers and Educators Take Part in Ceremony of Troy Technical School

Engineering News-Record Staff Report

Rensselaer Polytechnic Institute at Troy, N. Y., on Oct. 2-3, celebrated the 100th anniversary of its founding in two days of fairly continuous ceremonies which were participated in by eminent educators, delegates from practically every engineering society in this country, and a number of the leading societies abroad, and by a large body of the engineering alumni of the Institute. In addition to the unveiling of several commemorative tablets at different parts of the campus and an excellent pageant in the evening outlining the history of the school, the exercises consisted mainly in addresses by prominent educators and engineers.

PRINCIPAL ADDRESSES

The principal addresses were made by Secretary of Commerce Hoover, Sir Charles L. Morgan, president of the Institution of Civil Engineers of Great Britain; Henry Abraham, past president of the Society of Electrical Engineers of France; Luigi Luiggi, president of the Society of Civil Engineers of Italy; Arthur Surveyer, president of the Engineering Institute of Canada; C. E. Grunsky, president of the American Society of Civil Engineers; Fred R. Low, president, American Society of Mechanical Engineers; William Kelly, president, American Institute of Mining and Metallurgical Engineers; Farley Osgood, president of the American Institute of Electrical Engineers; Prof. Albert A. Michelson, president of the National Academy of Sciences; and Presidents Angell of Yale, Birge of Wisconsin, and Stratton of the Massachusetts Institute of Technology. At a banquet, at which about a thousand were present, the addresses were made by President Livingston Farrand of Cornell, H. W. Jervey, dean of the Law School of Columbia University, and J. H. Odell, of Wilmington, Del. Honorary degress of Doctor of Engineering were conferred on the heads of the engineering societies who spoke and of Doctor of Philosophy upon the presidents of the universities and Dr. Michelson.

The speakers contented themselves in the main in bringing from their respective institutions or societies greetings at the successful completion of a hundred years of service. One thought ran through most of the addresses, however—a tribute to the founders and executives of the Institute for the realization of the need for applying the facts of pure science to the actualities of life. It was recognized that Rensselaer was the first of

(Continued on p. 606)

Rensselaer Makes Founder Society Heads Doctors of Engineering

As noted in the report of the centenary of the Rensselaer Polytechnic Institute in another column, the degree of Doctor of Engineering was conferred on the president of each of the four national engineering societies on Oct. 4 by the Institute. Unlike some other universities, the Rensselaer Polytechnic Institute has been very chary in giving out honorary degrees. The award at this time to these men is therefore particularly noteworthy. The men honored were C. E. Grunsky, of the American Society of Civil Engineers, a consulting engineer in San Francisco; Fred R. Low, of the American Society of Mechanical Engineers, the editor of *Power;* William Kelly, of the American Institute of Mining and Metallurgical Engineers and a mining engineer at Houghton, Mich.; and Farley Osgood, of the American Institute of Electrical Engineers, the vice-president of the Public Service Co. of New Jersey.

Railway Maintenance-of-Way Men Hold Convention

Engineering subjects were prominent at the 42nd annual convention of the Roadmaster's and Maintenance-of-Way Association, held at New York in September. Among the papers presented were following: "Reducing Maintenance Expenses on the Lehigh Valley R.R.," G. L. Moore, engineer of maintenance-of-Way; "Rapid Tracklaying Methods on the Canadian Pacific Ry.," Emmett Keough, assistant engineer of maintenance-of-way; "Maintaining a High Degree of Line and Surface," W. J. Backes, assistant general manager, N. Y., N. H. & H. R.R.; "Grade Crossing Protection," F. W. Hillman, division engineer, Chicago & Northwestern Ry.; "Responsibilities and Duties of the Roadmaster," W. G. Besler, president, Central R.R. of New Jersey; "The Marking of Steel Rails," C. W. Gennet, Jr., of the Robert W. Hunt Co. Committee reports were as follows: (1) The efficient handling of work trains; (2) methods of rail laying and ballasting; (3) handling and disposing of cinders; (4) increasing the labor output in track work; (5) possibilities of winter track work. For the 1925 convention, the following subjects were selected: "Scheduling Track Maintenance Work," "Inspection of Ties for Renewal," "Prolonging the Service Life of Rails," "Methods and Costs of Weeding Track," "The Roadmaster's Responsibility in Public Relations." The new president is W. F. Muff, roadmaster, A., T. & S. F. Ry., Newton, Kan.; secretary, T. F. Donahoe, general supervisor of track, B. & O. R.R., Pittsburgh, Pa. The next meeting will be held at Kansas City, Mo.

City Engineering Problems Discussed at Convention

Society for Municipal Improvements Holds Thirtieth Annual Meeting at Boston

Engineering News-Record Staff Report

With about 300 members, associate members and guests present, the American Society for Municipal Improvements held its thirtieth annual convention at the Copley-Plaza Hotel, Boston, Sept. 29-Oct. 2. Papers and committee reports relating to various phases of city engineering problems occupied the major portion of the time of the convention, with street paving, city planning, sewage and refuse disposal and street lighting being the chief topics of discussion.

Among the special features of the meeting were a joint evening session with the Boston Society of Civil Engineers and the Northeastern Section of the American Society of Civil Engineers at the Boston City Club and an evening session and trip of inspection to the plant at West Lynn of the General Electric Co., where discussion centered on the topics of street lighting and traffic signals.

Supplementing the technical sessions there was an exhibit of equipment and materials in which 24 companies holding associate membership in the society participated. The main exhibit room was in the basement of the Copley-Plaza Hotel, widely separated from the convention hall, while several manufacturers displayed their products in a lot in back of the hotel. By those manufacturers who were assigned space in the basement room much dissatisfaction was expressed at the arrangements provided, inasmuch as a mere handful of members of the society was to be observed at any time in the exhibit room, due largely to its separation from the convention hall.

ATTENDANCE SLIM

At the technical sessions the attendance was small; the morning sessions started usually with about 25 members in the room, this number being increased to a maximum of 50 or 60 after the session had gotten under way. Judged by the attendance at the meetings and the general character of the papers and discussions, there was considerably less interest at this year's meeting than at former conventions of the society. It is possible that the simultaneous holding of the convention of the New England Water Works Association at Rochester, N. Y., had something to do with cutting down attendance, particularly among specialists in water supply, sewerage and sanitary engineering.

Acting unanimously on the report of its nominating committee, the society

elected the following new officers: President, E. L. Dalton, consulting engineer, Dallas, Tex.; first vice-president, T. Chalkley Hatton, chief engineer of the Sewerage Commission, Milwaukee; second vice-president, C. Arthur Poole, city engineer of Rochester, N. Y.; third vice-president, John B. Hittell, Chicago; secretary, Charles Carroll Brown, city engineer, Lakeland, Fla.; treasurer, P. L. Brockway, city engineer, Wichita, Kan. The finance committee was re-elected for another term; its members are W. A. Hansell, Atlanta, Ga., chairman; George F. Fisk, Buffalo; and G. J. Requardt, Baltimore. The report of the executive committee indicated a total membership of 670 in all grades; a statement of the society's finances showed a balance of $772.

In his presidential address, E. R. Dutton, assistant city engineer, Minneapolis, stated that there were about 75,000 civil engineers and surveyors in the United States and Canada. Of cities having a population of 5,000 or more, there are about 2,000, each of which has from one to several hundred engineers. There are about 10,000 engineers employed directly by municipalities who directed work in 1923, involving a total expenditure of 1¼ billion dollars.

Technical Session

Street Paving — The report of the committee on street paving by E. R. Conant, chairman, indicated a growing use, particularly in the Southwest, of natural rock asphalt. During the year, according to advice from the Asphalt Association, there has been no radical change in asphalt pavement design or construction, although there has been a decided gain in the employment of the so-called black base form of construction. Citing recommendations of the Granite Block Manufacturers Association, the report brought out the fact that the manufacturers believe a wider block than is used at present is desirable and would reduce costs. The width of the present standard block is from 3½ to 4½ in., while the proposed wider block would be from 4½ to 5½ in., saving about 50c. per square yard in cost construction. The need for a standard mixture of standard asphalt for granite block joint filler was pointed out.

In describing stone block pavement in Elizabeth, N. J., T. E. Collins, city engineer, stated that cement grout joint filler was superseded last year by asphalt filler delivered in tank trucks instead of barrels. The present status of rubber blocks for paving was discussed by E. S. Dorr, of Boston; an abstract of his paper appears on p. 594. Rubber paving blocks of several types are now being made from worn out automobile shoes. Paving blocks of this type are adapted to bridge floors, particularly draw spans. A number of specimens of reclaimed rubber block were displayed during the discussion on this paper. Clarence Pollock, consulting engineer, New York, offered suggestions for improving the subgrade of pavements (see p. 593), and Julius Adler, deputy chief of highways, Philadelphia, discussed paving in its relation to street railway track construction, bringing out a number of points covered in his article in this week's issue of *Engineering News-Record*, p. 582. George F. Fisk reported to the society on the status of simplification in paving brick, showing how 66 varieties had been reduced to 5. A number of practical points regarding granite block paving design and construction were brought out in discussions by R. A. MacGregor, Bureau of Highways, Borough of Manhattan, New York, and Nathan L. Smith (see p. 594).

City Planning—The powers of Massachusetts cities with regard to city planning were explained by Arthur C. Comey, Cambridge, while Jefferson C. Grinnalds, Baltimore, discussed the relation of parks to zoning. One of the principal papers of this session was on "Methods of Estimating Future Street Traffic," by E. P. Goodrich, consulting engineer, New York (see p. 593). A lively discussion was brought out by a paper on "Tree Planting," by R. J. Hayden, of the Boston Park Department. Along streets, he explained, trees should be set in pits at least 9 ft. square and 4 ft. deep, filled in with 1 ft. of clay and 3 ft. of friable loam and decomposed manure. The spacing should be about 40 ft. Trees best adapted to planting along highways are the Norway maple, the English elm, the red oak, and the pin oak, the European linden and the Oriental plane. Only one variety of tree should be placed along the same street, and in setting the young trees the best side of the tree should point north to insure symmetrical growth.

Street Lighting — The session on street lighting was held at the West Lynn works of the General Electric Co., following a boat ride around Boston Harbor on the afternoon of Oct. 1. Stephen C. Rogers, the company's illuminating engineer, described the latest type of street lighting equipment, laying stress on the use of special reflectors to produce a symmetric distribution of light for interurban roads and city streets. The newer types of lighting unit are equipped with an alabaster ripple glass globe. The company's largest single unit for street lighting is equipped with a 2,500-cp. incandescent lamp. In discussing Mr. Rogers' paper, O. F. Haas, of Cleveland, made the suggestion that street lighting should be controlled by zoning in the same way as are buildings. T. W. Rolph, representing the Holophane Glass Co., pointed out the need for conserving light which, without special devices in the form of reflectors, would travel upward and be wasted. There are now on the market both four-way and two-way refractors for thoroughfare lighting with 1,000-cp. units on 20-ft. poles. Lighting problems, Mr. Rolph said, may be grouped into three kinds: first, downtown lighting; second, residential district lighting, and third, thoroughfare lighting. Cluster lights, Mr. Haas pointed out, have been shown to be wasteful and have been replaced in present-day practice by single units of high power.

The General Electric Co. has developed an extensive line of electrically lighted units for street and highway traffic control which were explained by J. G. Regan with supplementary remarks by C. A. B. Halvorson, Jr., of the company's street lighting engineering department. These traffic control units are made in a number of designs for special conditions at street intersections, and are so designed that under no conditions can signals be set which will bring intercepting traffic lines together simultaneously. A feature of the equipment is the use of a mercury-filled tube for making and breaking electrical contacts. The company gave a demonstration of its application of flood lighting to athletic fields by staging football practice under artificial illumination at 10 p.m.

Sewage and Refuse Disposal — The sub-committee report on sewage disposal by Langdon Pearse, T. C. Hatton, and J. E. McVea stated that the outstanding developments during the year in the disposal of sludge by the activated-sludge process had been the abandonment of the MacLachlan process in Pasadena, the continued production by the Oliver type of press, the type of filter in use at the Calumet sewage treatment works in Chicago, and the development of a simple hydraulic direct squeeze bag press by Berrigan at the Des Plaines River sewage treatment works of the Sanitary District of Chicago. There appears, according to the report, to be a legitimate opening for activated sludge as fertilizer put on the market in the shape to pass an 8-mesh sieve with No. 18 wire.

A paper on the effect of industrial wastes upon sewage problems by Langdon Pearse—presented by S. A. Greeley—pointed out the need in many cases of preliminary treatment before discharge of sewage from industrial plants into the city's system. Many of the failures of garbage disposal plants, according to T. Chalkley Hatton, of Milwaukee, were due to poor engineering advice or none at all, dependence being placed upon the claims of promoters of plants or processes. A paper by Harrison P. Eddy, consulting engineer, Boston, started a lively discussion on practices of garbage disposal. S. A. Greeley said that one of the faults with most plants was the provision of insufficient capacity to handle material during peak periods in wet weather. In Indianapolis, according to John Elliott, city civil engineer, a big improvement in collection of garbage has been made by installing drainers in the trailers, thus ridding the wastes of much of their water content during transit to the point of disposal.

A description of the proposed 34-mile Merrimac Valley trunk sewer, to cost about $10,000,000, was given by X. H. Goodnough, chief engineer of the Massachusetts Department of Health.

Contracts and Specifications—W. W. Horner, St. Louis, reported his committee's recommendations on municipal contract forms. E. A. Kingsley re-

(Continued on p. 607)

Taylor and Winsor Are New Officers of N.E.W.W.A.

Count of ballots for officers at the 43d annual convention of the New England Water Works Association at Rochester, N. Y., last week, showed the election of Stephen H. Taylor, superintendent of water-works, New Bedford, Mass., as president by 279 to 3 while for vice-president all of the 282 ballots cast were for Frank E. Winsor, engineer of the Board of Water Supply, Providence, R. I. Alfred L. Sawyer was elected treasurer to succeed the late F. I. Winslow.

The Dexter Brackett Memorial Medal was awarded to Col. George A. Johnson, consulting engineer, New York City, for his paper on Rapid Sand Filters at Cambridge, Mass., read at the Burlington convention a year ago and printed since in the *Journal* of the association.

Besides their exhibit of appliances and entertainment for the ladies attending the convention the Manufacturer's Water Works Association provided an all-day excursion to Niagara Falls, with luncheon at the Temperance House. The excursion was on Thursday and was followed by a meeting that evening during which the manufacturers had the floor, as some of them did at other sessions.

Reports of the secretary and acting treasurer, Frank J. Gifford, Dedham, Mass., showed a total membership of 758. This is a net loss of 11 for the year, but the loss includes members dropped for non-payment of dues, a considerable percentage of whom will be restored. The editor of the *Journal*, John P. Wentworth, Boston, reported that the net cost of the *Journal* for the year was 74c. per member.

Abstracts of papers presented during the convention appear beginning on p. 576 of this issue.

General Morrow Resigns His Post as Governor at Panama

The resignation of Brig.-Gen. Jay J. Morrow, governor of the Panama Canal Zone for three and one-half years, has been accepted by the President, according to an announcement by the Secretary of War. General Morrow's resignation becomes effective on Oct. 15.

Upon the recommendation of the Secretary of War, the President has appointed Col. Meriwether L. Walker, Corps of Engineers, to be governor of the Panama Canal Zone, effective Oct. 16; and Col. Harry Burgess, Corps of Engineers, to succeed Col. Walker as assistant governor and engineer of maintenance.

Governor Morrow's resignation was submitted five months in advance of the expiration of the term for purely personal reasons. He has been desirous of entering private engineering practice for some months, and in August, 1922, prepared the way for such practice by transferring to the retired list of the army at his own request.

Governor Morrow expects to locate in New York City.

Construction Council Holds Annual Meeting

Roosevelt Retained as President and Boyd as Vice-President—Two New Officers

At the third annual meeting of the American Construction Council, held in New York, Oct. 2 and 3, a number of members heard a report from the president, Franklin D. Roosevelt, some addresses on the subject of building, and discussions on apprentices in the building trades and co-operation between the council and the various building congresses. Mr. Roosevelt was retained as president and D. Knickerbacker Boyd, of Philadelphia, as vice-president. Two new vice-presidents, Harry A. Wheeler of Chicago and George A. Harwood, of the New York Central R.R., were elected. The council itself remains practically as it was last year.

President Roosevelt, in his annual statement, said that there was a slight balance in the treasury, but the work required more money and more members. The main purpose of the council has settled down to an intention to co-operate with the public in all matters relating to the building industry. "Our field of publicity," Mr. Roosevelt said, "is the newspapers of the United States. It is our intention to give every six months a statement of conditions in the building industry prognosticated very cautiously. The principal work is to have two meetings a year to exchange ideas and give addresses on problems of construction. As a result of these meetings the newspaper statements will be given out. In addition to this major purpose, there are several things to be said. The apprenticeship question must be taken up, but that needs more money to make greater endeavor. Continued action is required to restrain speculative building, although the pronunciamentos of the council last year did much to restrain their speculations. Winter construction must be studied still more, and finally the matter of building congresses must be forwarded." It was Mr. Roosevelt's opinion that the American Construction Council, while not intending to dominate the building congresses, can act as a sort of clearing-house and can tell the cities how respective building congresses in different cities are constituted and are working.

Other Addresses

The further business at the first meeting was an address on better quality of construction, by Charles G. Edwards, of the National Association of Real Estate Boards; on contractors' bonds, by William B. Joyce, chairman of the National Surety Co., and an address by President Hartness, of the American Engineering Council, entitled "Prosperity Through Industrial Teamwork," which was a plea for the general co-operation of all elements in industry toward the end of bettering all those elements and the public in general.

A joint meeting between officers and members of the council and of building congresses was held at a luncheon. Stephen F. Voorhees, president of the New York Building Congress, who presided, expressed the view that there were functions both for a national and for a local organization and that a co-operative relationship between the two organizations was desirable. Robert D. Kohn, of the New York Building Congress, the earliest and most vigorous advocate of the building congress movement, welcomed the present efforts of the American Construction Council to spread a knowledge of what can be accomplished by local building congresses and commended its effort to exchange experiences between the congresses.

D. Knickerbacker Boyd, president of the Philadelphia Building Congress, told about the splendid welcome given to the building congress idea in the cities which he visited on a trip to the Pacific Coast in the interest of the council last year. The possible activity of the congresses which excited most interest was the relief of seasonal unemployment.

In reciting details of the work of the congresses, Mr. Boyd reported that the association of building owners and managers of Portland, Ore., co-operating with the building congress there, had urged all building owners and managers to refrain from doing repair and maintenance work during the summer so as not to interfere with new construction. Describing the Portland work further, Mr. Boyd said that the governor of Oregon had appointed two members to the governing body of the Portland Building Congress to represent the public.

In Philadelphia, the building congress last year, Mr. Boyd stated, had made a survey for the Board of Education. It had been reported to the Board that there were not sufficient building materials available to carry out a new school building program. It was proposed, therefore, to defer the construction of five buildings. The survey by the Congress demonstrated that the report was false, and the Board, therefore, proceeded with the construction of these five schools.

Minneapolis Terminal Expansion Plans Announced

The proposed three-year improvement program prepared by the receiver for the Minneapolis & St. Louis R.R. calls for the remodeling and expansion of the general shops of the company at Cedar Lake, equipping them with modern machinery and building a car repair shop at a total cost of $210,000, and the rearrangement of the terminal trackage at that point. The whole program calls for an expenditure of over $13,000,000. A large part of this amount is to be spent for new equipment.

International Ry. Congress to Meet in London in 1925

The next meeting of the International Railway Congress will convene in London on June 22, 1925.

Rensselaer Institute Holds Centenary Celebration

(*Concluded from p. 603*)

the now many engineering schools and that the idea of its founder, though much amplified even in the early years after the founding, was fundamentally to break with the classic idea of science and to make it a practical aid in the life of man. Secretary Hoover voiced this well when he said: "The realization that education of a body of men in pure science and in the humanities combined at the same time with a knowledge of the mechanic arts as the vital bridge over which science could alone become the implement of man is the notable contribution of this institution. From her sons and her influence has grown that great spread of engineering schools in our country and that army of half a million trained engineers who have builded our transportation, our communications, and our industries. Without this link for the skilled application of science to need, science itself would have to large degree remained locked up in our laboratories and libraries."

Danger of Specialization

President Farrand, of Cornell, voiced a warning against too intensive technical training in the technical schools. Drawing an analogy from his own profession, that of medicine, Dr. Farrand said that the engineering school today must not forget that after all it is training men as well as engineers, and that the great business of living requires a broad preparation, quite as broad as the business of being an engineer. This thought was echoed in the remarks of President Angell of Yale and Birge of Wisconsin, though the latter directed most of his attention to bringing greetings from the great land grant schools which rose nearly half a century after Rensselaer was founded. Dr. Michelson took a different view in his speech, in that, while recognizing the value of applied science and the contributions that the engineer has made to the world, he plead for a greater recognition of the pure sciences whose inadequate monetary return is discouraging in the extreme.

Rensselaer Polytechnic Institute was founded in 1824 by Stephen Van Rensselaer of Albany as the Rensselaer School. The founder, one of the most prominent men in the early history of our country, was a large land holder who had become persuaded that the agricultural and mechanic arts would gain by more intensive school training, and with the assistance, more probably at the instance, of Amos Eaton, a graduate of Williams College and one of the early botanists and geologists of the country, started this school "to qualify teachers for instructing the sons and daughters of farmers and mechanics by lectures or otherwise in the application of experimental chemistry, philosophy, and natural history to agriculture, domestic economy, the arts, and manufactures." Professor Eaton become the first head of the school, which soon outgrew its early intention, so soon in fact that in 1826 lectures on civil engineering appeared. In 1835 the trustees created a department for the purpose of giving instruction in engineering and technology and in that same year the first class in civil engineering was graduated. Several efforts at what might be termed engineering schools had been started in this country prior to 1824, but the Rensselaer Institute is the earliest of these now existing, and it is unquestionably the first to make as a definite purpose the training of engineers.

The whole school was reorganized in 1849-50 by B. F. Greene, a graduate of the Institute in the class of 1842. Director Greene made at that time a report on the subject of engineering education which marked a new view of the subject. The curriculum which he then proposed has been the basis of practically all later engineering school curricula, and it was used by the trustees of the Institute in the formation of a new kind of institution, and incidentally resulted in changing the name of the school to its present one of Rensselaer Polytechnic Institute. Civil engineering was the principal course given in the three or four decades after the reformation of the fifties; in the last two decades courses in mechanical, electrical, and chemical engineering have been added.

The present director, Palmer C. Ricketts, became the head of the Institute in 1892. He was graduated from Rensselaer in 1875 and became an assistant instructor in mathematics the same year. In 1882 he became an assistant professor and three years later was made professor of mechanics. In addition to his activities as director of the Institute for thirty-two years, he has been a practising consulting engineer, an author, and a lively participant in the municipal activities of the city of Troy.

Hartford Slow Sand Water Filters to Be Enlarged

Enlargement of the slow sand water filters at Hartford, Conn., operating results from which were given in our issue of Sept. 25, p. 508, will probably be undertaken next spring. It is proposed to add a covered filtered water basin to the plant also. The estimated cost of his work is about $500,000. C. M. Saville is manager and chief engineer of the Hartford Water Board.

Chicago Men Inspect Terminals

To assist in the study of the several railway terminal and track elevation projects now under construction at Chicago, a party of aldermen and local engineers has visited the terminal systems of Washington, New York, Quebec, Montreal and Toronto. The party included William Artingstall, consulting engineer for the Department of Public Works; Edward J. Noonan, consulting engineer for the council committee on railway terminals; Hugh Young and Eugene Taylor, engineer and manager of the Chicago Plan Commission; and John Mahoney of the Zoning Board.

Random Lines

Labor As She Is in the Sunny South

"I started right in as soon as I landed teaming out the excavation," writes a contractor who has just started a job south of Mason & Dixon's line. "I have 1 ditch pump, 1 hand pump, 4 teams, 3 carpenters, 3 Ku Kluxers, 1 Holy Roller, 4 Caseys, 2 niggers and 2 southern gentlemen who have lost their money and have to ditch for a living."

* * *

Not Since the Days of Moses

"Our forefathers showed much more foresight when they laid out the canal systems of the country than we did in laying out the railroads," says the editor of a certain daily paper in commenting on the grade crossing situation, "for they built overhead bridges spanning both the canal and tow-path wherever highways crossed the canals thus eliminating the grade crossing question for all time insofar as the canals of the country were concerned."

That *was* foresigt considering Moses was dead and there was no one else who could back up the waters every time anyone wanted to cross the canals.

* * *

Why British Building Is Slow

Robert D. Kohn, the New York architect, returning from a trip to Europe reports that on a steel frame building under construction on the Strand in London, the steel was being hoisted with a breast derrick operated by six men, only one beam being taken up at a time. Traffic was stopped in the Strand and a huge crowd had gathered to witness the operation. Mr. Kohn estimated that it would take several hours to hoist a truck-load of steel.

That evening he discussed the matter with the mayor of the borough in which the building work is situated. The mayor said he knew that building construction was much more rapid in the United States but he could not understand the methods. Mr. Kohn explained that two days before erection was to be started the contractor would telephone to the office of the electric light and power company, which would promptly send meters, switchboards, etc., so that within two days the hoisting could proceed with a powerful derrick operated by an electric motor.

The mayor was baffled. "How can it be done," said he, "when the building contractor is not a rate payer in the borough? What sort of application would he make out for the current?" To Mr. Kohn's protest that certainly the building owner was a rate payer in the borough and could secure the current, the mayor replied that "it takes about one year to pass an application for a current supply and by that time the building would probably be completed."

Treasury Finds No Evidence of Cement Dumping

Loss or Injury to Domestic Producers Not Due to Sale of European Cement to Customers

Washington Correspondence

On the grounds of insufficient evidence, the Treasury Department has declined to issue a dumping notice against importations of portland cement, thus giving victory to importers who for more than a year have been opposing efforts of Pacific Coast and Southeastern Atlantic domestic producers to secure such an order.

The Treasury began its investigation abroad a year ago, securing data from its special agents and from consuls. A lengthy hearing of interested parties was held before Assistant Secretary Moss several months ago, following which briefs were submitted.

The decision of the Treasury was announced in a letter addressed by Assistant Secretary Moss to the appraisers of merchandise at New York, Los Angeles, Portland, Honolulu and San Juan, as follows:

"The Department refers to previous correspondence and dumping notices issued covering importations of portland cement from various European countries. After careful consideration of all the evidence presented by and on behalf of the parties interested the Department has reached the conclusion that a finding of dumping with respect to importations of portland cement is not justified and must decline to issue such a finding.

"Appraisement reports covering imported portland cement need, therefore, no longer be withheld so far as any question of dumping is concerned."

The letter of the Assistant Secretary was based upon the following memorandum from E. W. Camp, director of customs:

"Neither the evidence adduced by the domestic manufacturers nor the official reports of the customs investigating officers establish with any certainty or definiteness that as a general practice, and taking into consideration the very great differences in wholesale quantities, cement has been sold to the United States by any of the countries in question at less than the foreign home market value. Moreover, this situation involves a number of doubtful questions of appraisement.

"The evidence of injury submitted by the domestic manufacturers is very general and in no case is any specific loss or injury directly traced to sales to their customers of European cement at less than the foreign home market values.

"The imports during 1923 from the countries accused of dumping were only 1.04 per cent of the total domestic production of the United States. Even admitting the claim of the domestic manufacturers that the seacoast districts where the imported cement is distributed should be considered as units independently of the interior of the country, the official statistics and the trade papers indicate wonderful prosperity of the cement industry in those districts in 1923 and 1924, with imports insignificant as compared with the domestic production and sales.

"In these circumstances, I recommend that no finding of dumping be issued."

This closes the portland cement case so far as the Treasury Department is concerned, unless specific evidence of dumping can be supplied by domestic manufacturers.

The Tariff Commission has been asked to make an investigation of the effect of importations of Portland cement upon the domestic industry, by one of the Southeastern manufacturers. Action on this request has been held up pending the Treasury's decision in the dumping charges. Whether it will be pressed now is uncertain. As portland cement is on the free list, all that could be done by the Tariff Commission would be to make a survey for the information of congress.

Baltimore & Ohio Centennial to Be in 1927

The state of Maryland has appointed a commission to represent the state and co-operate with civic and commercial organizations and with the railroad company in the celebration in 1927 of the centennial of the issuing of a charter to the Baltimore & Ohio R.R. The charter of the railroad, which was issued on Feb. 28, 1827, according to the joint resolution of the two houses of the Maryland Legislature, was the first charter issued to a railroad in the United States.

Property Owners Block Plans to Enlarge Terminals

Avarice of property owners in the block just west of the St. Louis Union Station has held up the plans of the St. Louis Terminal Railroad Association for doubling the size of the station, trainshed and yards.

The station enlargement plan included a proposal that the city vacate 20th St. to permit an addition to the station which would extend to 21st St. The terminal association has secured options or titles to much of the property needed for the improvement, but the owners of the remaining property have raised their prices to such an exorbitant figure that the railroad has refused to purchase.

A.S.M.I. Annual Meeting

(*Concluded from p. 604*)

ported a number of minor changes in his committee's specifications for bituminous pavement, while Dr. E. E. Butterfield, Borough of Queens, New York, submitted tentative recommendations for the committee on concrete pavements. Extracts from the latter proposed specifications appear on p. 595 of this issue.

The convention decided to hold its next meeting in Des Moines. A feature of the joint session on Sept. 30 was a moving picture "Power," furnished by Stone & Webster, Inc., showing the development of the steam engine and turbo-generator.

I. C. C. Approves Merger of Western Railroads

Control of El Paso & Southwestern To Pass To Hands of the Southern Pacific

The Interstate Commerce Commission, on Sept. 30, 1924, approved the application of the Southern Pacific Co for authority to control the El Paso & Southwestern system. Control will be had through purchase of the stock interest of the El Paso & Southwestern Co., by lease from the Southwestern of its lines, and by assignment from the Southwestern to the Southern Pacific of the leases whereby the Southwestern now operates the existing railways of the Southwestern system not owned by it, including the assignment of any and all trackage and operating rights of the Southwestern over other lines. The net book value of the Southwestern company's interest in the property is $62,000,000.

In commenting on its action the commission says: "The lines of the Southwestern system are intermediate between the lines of the Southern Pacific, and the lines of the Chicago, Rock Island & Pacific Ry. system. The lines of the three systems constitute one of the principal direct routes between southern California and the Missouri River and Chicago, and are included in the Southern Pacific-Rock Island System in the grouping of railroads under the tentative plant for consolidation. . . . Control of the Southwestern system by the Southern Pacific is in harmony with this plan. It will result in direct physical connection between the lines of the Southern Pacific and the Rock Island, will assure the continuance of this route, and will increase its competitive strength as compared with the routes of the Santa Fe and Union Pacific.

"The Southwestern Pacific has long had in contemplation double tracking its line between Tucson and El Paso. By acquiring the lines of the Southwestern system, the Southern Pacific will secure substantially all the advantages of double-track operation on a more favorable location than would result from double tracking its existing line. . . . Moreover, the control sought will result in operating economies and make possible the unification of standards and practices."

Railway Construction Authorized

The commission's order also authorizes the construction by the Arizona Eastern Railroad Co. of a line of railroad from the main line of the Southern Pacific at or near Picacho, Pinal County, northerly across the Gila River to a connection with the Chandler branch at or near Chandler, Maricopa County, a distance of 50.5 miles, together with a branch 7 miles long to the city of Florence; and a line of railroad from Hassayampa, Maricopa County, at the terminus of a branch of the Arizona Eastern, southwesterly to the main line of the Southern Pacific at or near Dome, Yuma County, a distance of 115 miles.

Calendar

Annual Meetings

THIRD ANNUAL ASPHALT PAVING CONFERENCE (under the auspices of The Asphalt Association, New York); Brown Hotel, Louisville, Ky., Oct. 13-15, 1924.

AMERICAN PUBLIC HEALTH ASSOCIATION, New York City; Annual Meeting, Detroit, Mich., Oct. 20-23, 1924.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York City; Fall Meeting, Detroit, Mich., Oct. 23-25, 1924.

AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS, Washington, D. C.; Annual Convention, San Francisco, Calif., Nov. 17-20, 1924.

AMERICAN ROAD BUILDERS ASSOCIATION, New York City; Annual Convention, Chicago, Ill., Jan. 5-9, 1925.

ENGINEERING INSTITUTE OF CANADA, Montreal; Annual Meeting, Montreal, Jan. 27-29, 1925.

AMERICAN CONCRETE INSTITUTE, Detroit, Mich.; Annual Meeting, Chicago, Ill., Feb. 24-27, 1925.

The Montreal Branch of the Engineering Institute of Canada announces its weekly meetings from October to December, inclusive. At the Oct. 2 meeting Frederick B. Brown gave a talk on impressions from the "World Power Conference," and Oct. 9 the "Stability of Dams" was the subject of C. L. Cate. Future meetings will take up the subjects of proprietary asphalt pavements, steel rails, grain elevators, the work of the Quebec Public Service Commission, chain drivers, improvements in design and appearance of concrete bridges, the La Gobelle development, and distribution cost of electric power.

The Chattanooga, Tenn., Engineers' Club will give a dinner Oct. 12 to a delegation from the American Institute of Mining and Metallurgical Engineers who will stop for the day in Chattanooga on their way to their annual convention in Birmingham, Ala.

The Washington (State) Association of County Commissioners and County Engineers held its annual convention in Bellingham, Sept. 17-19. The following officers were elected for the ensuing year: Engineers, Roy L. Greene, Lewis County, president; Fred McElmon, Whatcom County, vice-president; L. R. Sampson, Whitman County, secretary-treasurer.

The Winnipeg Branch of the Engineering Institute of Canada, at a meeting held on Oct. 2 received its charter which was presented by Major G. A. Walkern of British Columbia, vice-president of the Institute.

Personal Notes

DONALD M. BAKER, recently hydraulic engineer and examiner, State Department of Public Works, Division of Water Rights at Sacramento, Calif., has opened an office in the Central Building, Los Angeles, for the general practice of engineering, specializing in matters pertaining to irrigation, hydro-electric power, domestic water supplies, water rights and the handling of matters before state and federal commissions.

STANLEY H. WRIGHT has resigned as hydraulic engineer of the Gilbert C. White Co., Hendersonville, N. C., to become chief engineer of the Laurel Park Estates, Inc., of Hendersonville, and has opened an office for general consulting engineering on water supplies, hydraulic developments, and the complete engineering on large subdivision developments.

C. E. TABOR, engineer, and F. T. GEORGESON, architect, announce the opening of offices for consulting practice in the Standard Building, Eureka, Calif.

C. M. ENNIS, city engineer of Chico, Calif., has tendered his resignation; his successor is yet to be appointed.

BEN F. DUPUY, for the past two years city engineer of Glendale, Calif., has resigned, and JOHN F. JOHANNSEN, who has been with the city engineering department of Glendale since January, 1912, has been appointed to fill the vacancy.

ROY S. BRADEN, of Princeton, W. Va., was recently appointed city manager of Hopewell, Va.

DR. SAMUEL FORTIER, associate chief of the Division of Agricultural Engineering, Bureau of Public Roads, has been appointed consulting professor of irrigation investigations and practice in the College of Agriculture of the University of California. Doctor Fortier has for a number of years been in charge of the irrigation and drainage work of the department in the West.

JOHN B. CHALLIES, director of the Water Power Branch of the Canadian Department of the Interior has resigned to enter the service of the Shawinigan Water & Power Co. Mr. Challies who has had charge of the water power work of the Department of the Interior since 1911 was a member of the Dominion Power Board, of the Lake of the Woods Control Board, and of the recently created Dominion Fuel Board, and was active in the negotiations between Canada and the United States regarding the deepening of the St. Lawrence River and the power development project.

LESLIE R. THOMPSON, formerly secretary of the Lignite Utilization Board and at one time assistant engineer of the Dominion Bridge Co., Ltd., Montreal, has opened an office for consulting engineering practice in Montreal. Mr. Thompson is a graduate of the University of Toronto and was until 1912 a lecturer in the University of Manitoba, Winnipeg; since 1921 he has been special lecturer in structural engineering in the Department of Agriculture, McGill University. In his service with the Dominion Bridge Co., Ltd., he worked on design of bridges, buildings, and power houses, and especially on two projects, the design of the Stony sluice gates at LaSalle St., Montreal, and the large caissons for the new dry dock at Levis, P. Q.

Obituary

SIR WILLIAM PRICE, of Quebec, president and managing director of Price Brothers & Co., lumber, pulp and paper merchants of Quebec, and a prominent financier, met his death on Oct. 2 by being buried in a landslide at Kenogami, Chicoutimi County, Quebec. Sir William had gone to the locality accompanied by two engineers of the company to inspect the damage caused by a small landslide near the company mills. The three were standing just below the slide when a rush of water swept down a gulley followed by a landslide and the men were swept beneath it. The two engineers with difficulty managed to extricate themselves but Sir William lost his life. Sir William was identified with a number of lumber, pulp and power enterprises, and with his partner, J. B. Duke, was engaged at the time of his death on the development of water power on the Saguenay River near Kenogami for the supply of pulp plants and factories. He was 57 years of age; at 32 years he had become head of the business founded by his grandfather 105 years ago. In 1915 he was knighted for services rendered during the war. He had been a member of the Dominion Parliament and president of the Quebec Board of Trade and chairman of the Quebec Harbor Commission.

CY MOREING, street paving contractor of Stockton, Calif., died in that city Sept. 8, following an illness of several weeks.

J. STEWART DOUGLAS, senior member of the contracting firm, Douglas, Burt & Buchanan Co., Shreveport, La., died recently after a brief illness. Mr. Douglas had large planting and mercantile interests at Dixie, La. He had for twelve years been a member of the Louisiana state legislature.

LOUIS NAPOLEON RHEAUME, former consulting engineer for the Canadian government, with the Department of Railways and Canals, under whose supervision locks and waterways on the St. Lawrence river at Soulanges, the Long Sault and Prescott, were built, died at his home in Ottawa, Ont., Oct.4, aged 77 years. Mr. Rheaume was the last surveyor of the original party of geological surveyors who set out in 1872 to map out the first route which it was proposed the Canadian Pacific Ry. should follow through the Rockies. Mr. Rheaume was a member of the Engineering Institute of Canada. He was pensioned from the government service four years ago.

JOSEPH PAQUET, contractor, Portland, Ore., who has been identified for many years with important private and public work in Oregon and Washington, died recently at his home in Portland aged 83 years. Mr. Paquet went to Portland in 1853, the year after its incorporation.

From the Manufacturer's Point of View

A Point of Contact Between Maker and User of Construction Equipment and Materials

Industrial Electric Locomotives

The Department of Commerce announces quarterly data on shipments of mining and industrial electric locomotives, collected from 9 firms, comprising the entire industry. Below is shown a summary of shipments, by classes, for the quarter ending June 30, 1924, with a comparison for the quarter ending March 31, 1924. Totals are also given for the year 1923.

SHIPMENTS OF ELECTRIC LOCOMOTIVES

Type of Locomotive	Quarter ending June 30, 1924 Number Shipped	Value	Quarter ending March 31, 1924 Number Shipped	Value
Mining locomotives:				
Trolley type	98	$486,493	112	$554,950
Storage-battery type	36	162,353	28	128,615
Total	134	$648,846	140	$683,565
Industrial locomotives:				
Trolley or third-rail type	9	$150,112	19	$147,139
Storage-battery type	12	69,714	26	143,892
Total	21	$219,826	45	$291,031

SHIPMENTS OF ELECTRIC LOCOMOTIVES, TOTAL FOR 1923

Type of Locomotive	Number Shipped	Value
Mining locomotives:		
Trolley type	1,024	$4,628,981
Storage-battery type	249	1,291,885
Total	1,273	$5,920,866
Industrial locomotives:		
Trolley or third-rail type	10	$60,942
Storage-battery type	51	239,362
Total	61	$300,304

Concrete Bricks and Hollow Tile to Be Simplified

Concrete producing organizations, manufacturers of machinery for making concrete bricks, hollow building tile and blocks, and associations whose members are engaged in construction work involving the use of these products have been invited by the Division of Simplified Practice, Department of Commerce, to attend a conference

RECOMMENDED SIZES

	Height, In.	Length, In.	Width, In.
Conc. blocks	7½	15½	6, 8, 10 or 12
Conc. bldg. tile	5	12	3½, 8, 12
Conc. brick	2½	8	3½ (smooth) 3¾ (rough)

in the Hotel Sherman, Chicago, Oct. 16, to act on recommendations that these products be standardized.

The recommendations have been prepared after a survey of the industry which indicates that there is a considerable variety of concrete blocks, building tile, and brick manufactured in sizes and dimensions which differ but slightly and yet which impose a burden on architect and contractor and indirectly upon the user. The committee which made the survey, comprising H. A. Davis of New York City, of the American Concrete Institute; Newton D. Benson of Providence, R. I., J. A. Ferguson of Philadelphia, M. W. Plumb of Malone, N. Y., and J. W. Oehmann, assistant inspector of buildings of Washington, D. C., began its work some months ago.

Business Notes

L. A. BABCOCK, for the past nine years sales manager of the Byers Machine Co., Ravenna, Ohio, announces his resignation effective Sept. 15. While giving up active association with the company, Mr. Babcock retains his financial holdings there, the change giving him the opportunity to devote time to outside interests.

UNITED STATES GYPSUM CO., Chicago, has recently rebuilt the Sheetrock wallboard unit of its plant at Fort Dodge, Ia., increasing its capacity to 225,000 ft. a day with provision for further expansion up to a daily capacity of 50,000 ft. more than the plant had before this year. The reconstruction necessary to this increased capacity cost $150,000 and makes the plant one of the three largest gypsum-working establishments in the world.

C. L. BERGER & SONS, INC., Boston, makers of engineering and surveying instruments, have appointed the New York Blue Print Paper Co. as their export agent for Latin America, in addition to the New York and New Jersey territory which it already covers.

GENERAL MOTORS TRUCK CO. has appointed V. H. Day and B. M. Price as regional vice-presidents, the former with headquarters in San Francisco, the latter in New York. Charles H. Engelman, until recently wholesale manager of the New York territory, has been appointed general sales manager with headquarters at Pontiac, Mich.

REPUBLIC MOTOR TRUCK CO., INC., Alma, Mich., announces the appointment of Robert S. Taylor as distributor for Republic motor trucks in Seattle, Wash. The salesroom and a service station are located at 401 East Pine St.

SHEFFIELD STEEL MILLS, Kansas City, Mo., announce the appointment of J. C. Shepherd and J. W. Anderson as assistant general managers of sales.

CHAUSSE OIL BURNER CO., producers of kerosene torches, tool and surface heaters, and its associate the White Manufacturing Co., manufacturer of railway car parts, have moved to a new factory at Elkhart, Ind., following a fire which seriously damaged their plant at Goshen a few weeks ago.

Equipment and Materials

Rubber Paving Block Equipped with Self-Anchoring Lugs

Rubber pavements have been a subject of experimentation since 1871 when a street in London, England, was surfaced with this material. Rubber offers many advantages as a pavement for highways and bridges and for general industrial tiling uses, such as the surfacing of freight terminals and loading platforms. Besides being relatively noiseless it takes up the shocks and jars of traffic and transmits much less vibration than stone or wood. For use on bridges the blocks are set in a plastic asphalt base instead of concrete. The principal difficulty thus far has been the problem of permanently attaching the rubber blocks to the road

surface to prevent the traction wave from causing the blocks to move or creep.

A new type of block invented and developed by Rufus F. Herrick of Boston and manufactured by the Boston Woven Hose & Rubber Co., Boston, Mass., is distinctive in type and is designed to overcome the difficulty which has prevented the adoption of rubber paving up to the present time. It is 6 x 12 in. in plan and 1¼ in. thick. The Herrick block does not have to be spiked to a wooden plank base or fastened into position with steel ties or cemented to a composition bed as do the previous designs. Instead it is equipped on the under side with parallel rows of ½-in. lugs which anchor the block firmly in a cushion course consisting of a cement-sand mixture for roads and an asphalt-sand mixture for bridges. In the manufacture of the blocks reclaimed rubber is used.

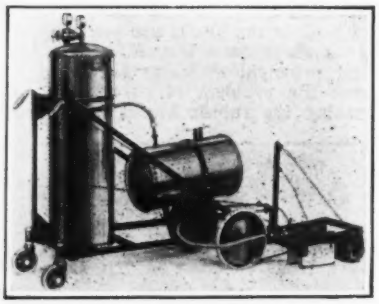
The blocks are set and rolled into the bed while the concrete is in a plastic state. As the concrete hardens and coheres strongly to the lugs or lips on under side of the block the paving is locked securely in position. The manufacturer points out that no special form of roadbed construction is required by the use of these rubber blocks either in

laying new roadways or repairing old ones.

Blocks of the type described were exhibited last week at the convention in Boston of the American Society for Municipal Improvements.

Machine Paints Traffic Lines

A new device for marking traffic lines on streets and highways is the Ault machine manufactured by the Tennessee Tool Works, Inc., Knoxville, Tenn. This machine, its manufacturer states, lays an average of 200 lin.ft. of line per minute, 3 to 8 in. wide, and is operated by one man. The machine, shown in the accompanying illustration, weighs 160 lb. and is mounted on ball

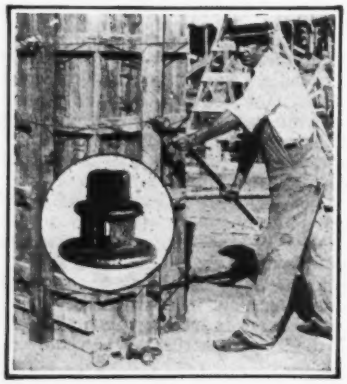


and roller bearings, rubber-tired, disc steel wheels. Compressed air forces the marking material between shields and wiper brushes, and all surfaces to be painted are cleaned in advance by a revolving brush. The device is particularly adapted to the painting of safety and parking zones, intersections, curves and other traffic lines.

An extra attachment provides for spraying fire plugs, posts, guard rails, under-passes, etc., also direct spraying of letters, arrows, etc., on to stencils. Air supply may be obtained from any automobile service station, and will supply the necessary pressure for the average day's work.

Wall Form and Column Clamp

For clamping wall forms and columns the Washington Steel Form Co., Washington, D. C., has placed on the market the Bullis form clamp, a one-piece casting with square head and cylindrical barrel through which is a slot for receiving the tie wires from the forms. After the wire has been threaded through the slot in the clamp, the latter is turned with a long handled wrench

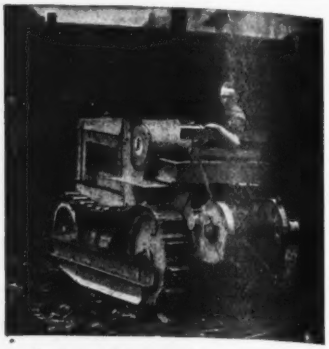


until the wire is tight. Nails are then driven through two holes in the base of the clamp to hold the latter in position against the twisting action of the stressed wire. The accompanying construction photograph and detail of the clamp explain the application of this device.

Winch Attachment for Tractor

The J. T. Tractor Co., Cleveland, has just announced a new attachment in the form of a winch which fits on the rear end of the machine and becomes an integral part of it. This device is intended for a variety of uses in the engineering and construction field where, because of the nature of the ground and the kind of material to be handled the tractor cannot be hitched directly to the load. In raising towers for transmission lines, in lowering sewer pipe into trenches, for handling heavy materials in bridge construction, for pulling mired trucks out of holes, and hauling material up steep grades, such an attachment is an asset.

The winch consists of a drum 9 in. in diameter by 22 in. long, which will hold 800 ft. of ½-in. cable. The drum is supported by a steel shaft running in bearings, located in two heavy steel castings bolted to the rear end of the frame. The drive is through the regular tractor transmission (which is of the automobile type) and has three



speeds in raising and one in lowering. A nigger head is provided on the right side of the winch, for operating snatch-blocks, etc.

Concrete Products Machinery—BESSER SALES CO., Chicago, has just issued an illustrated catalog of its concrete products machinery including hand and power units for making concrete block and tile and batch type mixers with capacities of from 5 to 21 cu.ft. The line includes automatic and semi-automatic machines for casting blocks, brick, hollow tile, building tile, silo staves and partition tile, in addition to power tampers, batch and continuous mixers, and deck cars for the transport of concrete block.

Business Side of Construction

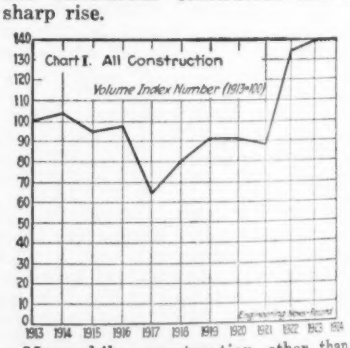
FACTS AND EVENTS THAT AFFECT COST AND VOLUME

Twelve Year Analysis of Construction Volume —1924 Expected to Top 1923

Buildings the Most Active Class—Public Work Increasing Steadily Since 1918

Some indication of the construction needs of the country may be had by comparing the volume of the last dozen years with what may be regarded as the normal development of the country. Had construction gone forward at the 1913 rate, without any increase of the rate from year to year, the eleven-year total would have exceeded $9,000,000,000, allowing for a total increase in cost of 40 per cent over that period. Actually, cost has averaged 66 per cent above 1913, and at this level the 1913 rate would have aggregated nearly $13,000,000,000. Actual construction has been less than $12,000,000,000. In other words the actual gross volume of construction is slightly below what it would have been had the 1913 rate continued. These are *Engineering News-Record* statistics, as are those that follow:

Chart I shows the actual trend of engineering construction (exclusive of residential) over the last twelve years. The curve does not represent mere money value, with the dollar worth from 88 cents to $2.74, but the actual physical volume of contracts awarded. It is the *E. N.-R.* Construction Volume Index Number, in which the annual value of contracts awarded is reduced to the 1913 base. Construction in 1913 to 1916 was steady, the war having little effect until 1916, when industrial and commercial construction took a sharp rise.



Meanwhile, construction other than buildings went forward at a more conservative rate. The 1914 volume was $80,000,000 less than the 1913, while 1915 was $85,000,000 under the preceding year's total. Since 1915 the trend has been consistently upward.

There is much room yet for develop-

ment in this division — water-works, bridges, sewers, earthwork, etc. Had this work gone forward at the 1915 rate during the last eleven years it would have aggregated $5,400,000,000. Contracts actually awarded in that period amount only to $5,800,000,000, although the average unit costs are much above the 1913 figures. This is an annual increase of 8 per cent. Since 1921 the increase has been 12 per cent.

BUILDINGS THE MOST ACTIVE CLASS

Building construction has been consistently heavy since 1918, as Chart II shows (1924 estimated). Of course 1916 to 1920 was the heyday of industrial

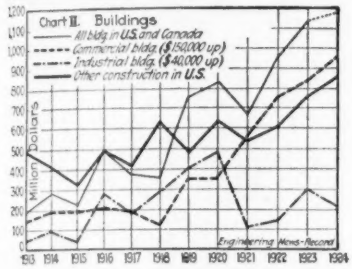
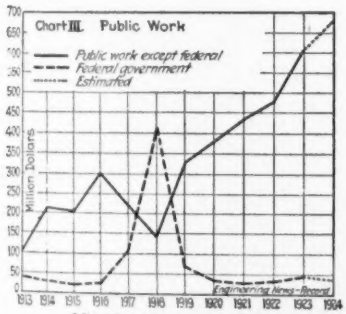


Chart II. Buildings
All bldg. in U.S. and Canada
Commercial bldg. ($150,000 up)
Industrial bldg. ($40,000 up)
Other construction in U.S.
Million Dollars
Engineering News-Record
1913 1914 1915 1916 1917 1918 1919 1920 1921 1922 1923 1924

expansion. In 1920 alone the value of industrial building contracts of $25,000 and over aggregated $482,000,000 compared with $49,000,000 in 1913, and $42,000,000 in 1915. The slump in 1921 was abrupt—to $114,000,000. In 1913 to 1915 the yearly average was $60,000,000. In eleven years this would have amounted to $1,100,000,000, allowing for the depreciated dollar. The cost of the actual construction was $2,424,000,000.



(Continued on p. 612)

No Drop in Steel Production—Lumber and Cement Gaining—Recession in Brick

Few Chances of Cement Demand Exceeding Supply—Lumber Movement Not Unfavorable Compared with Abnormal 1923 Volume

Steel—Present rate of mill operations is around 60 per cent of capacity. The same rate prevailed at about this time last month. Production, however, is somewhat above that of any year previous to 1917 and but slightly under the best year since 1918. Tin plate, car materials and steel rails form the bulk of the current steel demand.

Lumber—Production, shipments and orders all showed increases during the week ended Sept. 27 as compared with the previous week, according to the National Lumber Manufacturers' Association. This marked decrease in all three factors compared with the corresponding week in 1923, is not considered to be of much significance, because the lumber movement at that time in 1923 was abnormally large for the season of the year.

The weekly comparison of lumber movements follows:

Mills	Week Ended Sept. 27 Ft.b.m. 372	Corresponding Week in 1923 Ft.b.m. 380	Preceding Week in 1924 Ft b.m. 364
Production....	239,994,095	283,331,366	227,811,688
Shipments.....	239,413,036	270,760,686	222,405,094
New business..	230,366,261	291,038,750	224,844,143

The following table shows the lumber movement for the first thirty-nine weeks of 1924, compared with the same period last year:

	Production Ft.b.m.	Shipments Ft.b.m.	Orders Ft.b.m.
1924	9,133,527,643	9,048,291,783	8,778,042,802
1923	9,545,920,487	9,560,383,825	9,072,685,611
1924 decrease	412,392,844	512,092,042	294,642,809

Cement—The industry evidently aims to reach an annual producing capacity of 175,000,000 bbl. by the end of next year, judging from the number of new mills being constructed from time to time. With this tremendous capacity no possibilities of a future demand in excess of supply are evident. According to the Geological Survey, the total output for the nation was 95,944,000 bbl. for the first eight months of this year, against 88,318,000 for the corresponding period last year. At the present rate, the record total of 137,460,238 bbl. for the entire year 1923 will be exceeded this year.

Brick—Latest reports of the Common Brick Manufacturers' Association of America show a slight seasonal recession in the national brick movement and a slightly larger number of burned brick on hand at yards, compared with the month preceding.

The brick situation compared with a month ago and one year ago, is shown in the following tabulation:

1923	Burned Brick on Hand M.	Unburned Brick On Hand M.	Brick Moved from Yard During Month M.	Orders on Books M.
Sept. 1	250,176	85,904	.....	330,712
1924				
June 1	223,458	70,802	163,298	394,156
July 1	258,474	72,725	158,753	366,098
Aug. 1	231,182	86,722	149,622	314,588
Sept. 1	261,800	68,138	120,777	256,017

Business Briefs

Call money ranged from 2½ to 3 per cent, Oct. 6.

Time loans; short terms, 2½@3 per cent; longer periods, 3¼@3½ per cent.

Commercial paper; best names 3@3¼ per cent; other names, 3½ per cent.

Foreign exchange (Demand):

	Normal	This Week	Last Week	Year Ago
Sterling.....	$4.8665	$4.45⅞	$4.44¼	$4.55⅞
Franc.....	0.193	0.0524½	0.0524	0.0600½
Lira.....	0.193	0.0435½	0.0437½	0.0452½

Bids Wanted on Big Jobs

Among the projects in Construction News, pp. 197 to 209, on which bids are either asked or will soon be called, are the following:

School, East Boston, Mass., by Schoolhouse Dept., $1,300,000.

Sewerage system, St. Paul, Minn., by H. W. Austin, city purch. agt., A $1,000,000, B $300,000, C $25,000.

CONDITIONS OF MATERIALS STOCKS IN IMPORTANT CENTERS

Stocks on hand in approximate figures, example: (Lumber, Detroit, 10,000,000 ft.); time required for delivery of carload lots to city job, example (Hollow tile, Atlanta, deliveries take 4 to 5 days); and stocks on hand in general terms, example: (Sewer pipe, Minneapolis, ample).

	San Francisco	Denver	Detroit	Minneapolis	New Orleans	Atlanta	Philadelphia	New York
Sewer pipe	Plenty all sizes	Shipments just keeping abreast of orders	Moderate supplies in local yards	Stocks ample; mill del. prompt	Stocks plentiful; demand good	Del. take 4 to 5 days	Stocks approximate 120 carloads	Dealers' stocks usually small
Cement	Fairly well supplied	Stocks in good shape	Dealers' stocks ample; mills nearby	Ample on hand	Sufficient	About 60 to 70 cars on sidings	Only enough to cover current demand	Reserve stocks decreasing
Lime	Sufficient for current demand	Enough	Good del. from Mich. and Ohio kilns	Quick del. from kilns	Adequate	75 cars	Ample for requirements	Dealers' stocks usually small
Common brick	Large reserves at yards	18,000,000	Immediate del.; any quantity	Good supply near at hand	Normal	Plenty	Supply greater than demand	Fewer unburned brick at yards; demand increasing
Hollow tile	Plentiful	Del. 15 days behind orders	Large del. require several days	Obtainable in short order	Ample	Del. take 4 to 5 days	Small amount on hand	Dealers' stocks usually small; prompt del. by rail and water
Lumber	Unusually large reserves in yards	Stocks low; mills curtailing output	About 10,000,000 ft.; del. prompt	Normal in city	Pine stocks low; demand quiet	Plenty	Ample in local yards	Stocks smaller; demand slower than year ago
Asphalt	Extensive native reserves	Limited quantity on sidngs		Quickly obtainable from source	200 tons on hand; 1,000 required	75 cars	Practically none on hand	Ref. near city
Structural steel	Warehouses well stocked particularly in reinforcing materials	Warehouses well stocked		Plenty in warehouses; mill del. prompt	Plentiful; demand quiet	About 4 cars	Small warehouse stocks	Structural demand better; stocks moderate

Analysis of Construction

(*Continued from p. 611*)

While the war was largely responsible for the slump in the industrial curve in 1919-1920, it has nothing to do with the fact that for the last four years such buildings average annually four times the value in 1913. The 1924 figure should exceed $200,000,000.

Before the war, contracts for commercial buildings (banks, offices, stores, hotels, apartments) averaged $180,000,000 per year. At this rate they would have reached $3,000,000,000. The actual figure is $4,144,000,000. This class of building is booming, and the 1924 total will break last year's record. *Engineering News-Record* expects to report $950,000,000 worth of commercial building contracts this year—an increase of 11 per cent over the record year, 1923.

Chart III shows that while municipal, county and state construction has been increasing steadily since 1918, federal government work has followed a remarkable flat curve except for the peak occurring in 1917 and 1918.

The 96 contracts for power projects published this year in Construction News total $43,627,000.
Watch this section for details soon to be presented.

Weekly Construction Market

THIS limited price list is published weekly for the purpose of giving current prices on the principal construction materials, and of noting important price changes on the less important materials. Moreover, only the chief cities are quoted.

Valuable suggestions on costs of work can be had by noting actual biddings as reported in our Construction News section.

The first issue of each month carries complete quotations for all construction materials and for the important cities. The last complete list will be found in the issue of October 2, the next, on November 6.

Steel Products:	New York	Atlanta	Dallas	Chicago	Minneapolis	Denver	San Francisco	Seattle	Montreal
Structural shapes, 100 lb.	$3.34	$3.80	$4.15	$3.10	$3.35	$4.00	$3.00	$3.35	$3.50
Structural rivets, 100 lb.	3.75	4.35	4.75	3.50	3.75	4.65	5.00	3.75	6.00
Reinforcing bars, ¾ in. up, 100 lb.	3.24	3.30	3.38	3.00	3.25	3.87½	3.35	3.25	3.25
Steel pipe, black, 2½ to 6 in. lap, discount	44%	54.2%	43%	53%	55.05%	36%	36.80@49.10%	45%	37.83
Cast-iron pipe, 6 in. and over, ton.	56.60@57.60	—54.00	59.00	56.20@57.20	55.50	68.00	56.00	65.00	65.00
Concreting Material:									
Cement without bags, bbl.	.2.50@2.60	2.35	2.05	2.20	2.42	2.84	2.61	2.90	1.80
Gravel, ¾ in., cu.yd.	1.75	1.90	2.38	2.75	1.85	1.90	2.15	1.50	1.25
Sand, cu.yd.	1.00	1.40	2.00	2.75	1.25	1.00	1.50	1.50	1.25
Crushed stone, ¾ in., cu.yd.	1.85	2.00	2.83	2.75	1.75	3.50	2.15	3.00	2.25
Miscellaneous:									
Pine, 3x12 to 12x12, 20 ft. and under, M.ft.	—55.00	35.00	57.20	55.00	37.75	34.75	29.00	26.00	60.00
Lime, finishing, hydrated, ton	18.20	22.50	20.00	20.00	25.50	24.00	22.60	24.00	21.00
Lime common, lump, per bbl.	2.50@3.00	1.45	1.85	1.50	1.40	2.70	2.15	2.80	10.50
Common brick, delivered, 1,000	+18.00	11.00	12.10	12.00	14.00	12.00	15.50	15.00	17.50
Hollow building tile, 4x12x12, per block	Not used	.1004	0.941	.089	—.07	.085	.....	.11	.12
Hollow partition tile 4x12x12, per block	.1162	.1004	.094	.089	.....	.085	.108	.11	.10
Linseed oil, raw, 5 bbl. lots, gal.	1.03	—1.10	1.20	1.05	+1.08	—1.17	1.14	—1.12	1.16
Common Labor:									
Common labor, union, hour.	.75	.30	.....	.82½	.....	.50@.55	.55	.62½	.....
Common labor, non-union, hour.	....	.25	+.40@.75	.75	.50@.55	.35@.50	.50	.62½	.30@.35

Explanation of Prices—Prices are to contractors in carload lots unless other quantities are specified. Increases or decreases from previous quotations are indicated by + or — signs. For steel pipe, the prevailing discount from list price is given; 45-5% means a discount of 45 and 5 per cent.

New York quotations delivered, except sand, gravel and crushed stone, alongside dock; common lump lime, in 280-lb. bbl. net, and hydrated lime f.o.b. cars; tile "on trucks"; linseed oil and cast-iron pipe f.o.b.

Labor—Concrete laborers' rate, 93¾c.; building laborers, 75c.; excavating laborers, 62½c. per hr.

Chicago quotes hydrated lime in 50-lb. bags; lump finishing lime per 180-lb. net. Lumber delivered on job.

Minneapolis quotes on fir instead of pine. Brick, sand and hollow tile delivered. Cement on cars. Gravel and crushed stone quoted at pit. We quote on brown lime per 180-lb. net; white is $1.80 for Kelly Island and $1.70 for Sheboygan. Common labor not organized.

Denver quotes on fir instead of pine. Cement "on tracks"; gravel and sand at pit; stone on cars; lime, brick, hollow tile and lumber on job. Tile price is at warehouse. Linseed oil, delivered, in wooden bbl. Common lump lime per 180-lb. net.

Atlanta quotes sand, stone and gravel per ton instead of cu.yd. Common lump lime per 180-lb. net.

Dallas quotes lime per 180-lb. bbl. Steel, cement, cast-iron pipe and crushed stone f.o.b. cars, other materials delivered.

San Francisco quotes on Heath tile, size 5½ x 8 x 11½. Prices are all f.o.b. warehouses except C. I. pipe, which is mill price plus freight to railway depot at any terminal. Common lump lime per 180-lb. net. Lumber prices are to dealers in yards at San Francisco, for No. 1 fir, common.

Seattle quotes on Douglas fir (delivered) instead of pine. Lump finishing lime per 180-lb. net. Hollow building tile delivered. Hydrated lime in paper sacks. Sand and gravel at bunkers.

Montreal quotes on pine lumber. Sand stone, gravel and lump lime per ton. Stone, lime and tile are delivered; sand, gravel and cement on siding; brick f.o.b. plant; steel and pipe at warehouse. Hollow tile per ft. Cement price is in Canadian funds (the Canadian dollar stands at 99.96. Bag charge is 80c. per bbl. Discount of 10c. per bbl. for payment within 20 days from date of shipment. Steel pipe per 100 ft. net; 2½-in., $37.83.

Conditions Affecting the Market

While advances are in excess of declines in the wholesale commodities' markets, building materials, particularly brick, tile, red cedar shingles, yellow pine flooring and paint materials excepting linseed oil, are firmer in the cities reporting regularly to *Engineering News-Record*.

Some strength has also developed in non-ferrous metals, textiles, grains, leather and steel for railroad use. Latest reports of bank clearings show increased volume and freight loadings for the week of Sept. 20 were but 20,721 cars under the heaviest weekly loadings for the record year 1923.

The American Railway Association reports loadings, during the week mentioned, at 1,076,553 cars, against 1,097,274, for the week of Sept. 29, 1923, which was the greatest number loaded in a single week in the past four years. The significant gains were in grains, grain products, fuel, ores, merchandise in less-car-lots and miscellaneous freight.

Lime prices are slightly firmer in most of the large cities of the country. New York, however, has experienced a recent decline in common lump.

Common brick are now $18 per M., delivered in New York, against $17, one week ago. The advance in this market is attributed to continued demand in the face of early closing down of brick yards in the Hudson River district. Brick prices have also risen in the Dallas district during the past two weeks and firmness is reported in hollow tile.

Long leaf yellow pine timbers declined $1 per M. ft. in New York since Oct. 2 and weakness in Douglas fir structurals developed in San Francisco.

Raw linseed oil declined 1c. in Seattle, 2c. in Atlanta and 6c. per gal. in Denver during the week. This is contrary to the trend of other paint materials.

Common labor is being paid less in Chicago than formerly where unskilled men of the pick and shovel type are concerned. In Dallas, however, the present heavy demand in the cotton fields has resulted in an advance of 15c. per hr. in that district.

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